STOPPING WATER POLLUTION AT ITS SOURCE

MISA

Municipal/Industrial Strategy for Abatement

THE DEVELOPMENT DOCUMENT FOR THE DRAFT EFFLUENT MONITORING REGULATION FOR THE METAL CASTING SECTOR

Environment Ontario

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FOREWORD

The Municipal/Industrial Strategy for Abatement (MISA) program is aimed at reducing discharges of toxic contaminants to Ontario's waterways. The ultimate goal of the MISA program is the virtual elimination of persistent toxic contaminants from all discharges to Ontario's receiving waters.

Under the MISA program, the monitoring requirements for each sector are specified in two regulations - The General Effluent Monitoring Regulation (Ontario Regulation 695/88) and the relevant sector-specific regulation.

The General Effluent Monitoring Regulation provides the technical principles which are common to all sectors. It covers the "how to" items such as sampling, chemical analysis, toxicity testing,flow measurement and reporting.

The sector-specific regulation specifies the monitoring requirements of each direct discharger, such as the actual parameters to be monitored, the frequency of monitoring and the regulation in-force dates.

This document contains:

1. An overview of the metal casting sector which includes descriptions of the Ontario Metal Casting Sector plants.
2. The Technical Rationale document for the Metal Casting Sector in Ontario which describes the derivation of the monitoring parameters and the monitoring frequencies that are used in the Effluent Monitoring Regulation.
3. The Draft Effluent Monitoring Regulation for the Metal Casting Sector in Ontario.
4. Explanatory Notes which describe the legal terms used in the Regulation.
5. The MISA Advisory Committee's (MAC) report to the Minister of the Environment on the Draft Effluent Monitoring Regulation for the Metal Casting Sector.
6. The Ministry of the Environment's response to the MISA Advisory Committee report.

The General Effluent Monitoring Regulation, which must be used in conjunction with the sector specific regulation, is published under separate cover. The same document also includes a discussion of the MISA approach to effluent monitoring.

PART I

THE METAL CASTING SECTOR

PART I - THE METAL CASTING SECTOR

I INTRODUCTION

In order to understand the Metal Casting Sector Effluent Monitoring Regulation and the rationale behind its development, a clear understanding of the industry is required. The first part of this development document serves as an introduction to the sector. It defines the metal casting sector, briefly describes the technologies used with respect to both manufacturing and environmental control processes and describes some of the industries.

II SECTOR DEFINITION

The metal casting sector includes those industries that manufacture metallic objects by cooling molten metal in a mold or die. Within this broad definition, a variety of industries exist due to the different metals that may be used, molding techniques employed and finished products produced. The sector can be subdivided into ferrous and non-ferrous casters, die casters and foundries and even further sub-divided into specific metal groups and casting techniques.

The metal casting sector is represented by three associations:

i) The Canadian Foundry Association (CFA);

ii) The Ontario Chapter of the American Foundrymens Society (AFS);

iii) The Canadian Die Casters Association (CDCA).

The CFA and CDCA are business associations which represent industries. The AFS is a technical society for individuals.

A search of association memberships and government statistics identified over 300 metal casting plants active in Ontario. A complete list of these plants is presented in the Metal Casting Industry Economic Profile listed in the bibliography. A survey of these plants showed that they significantly differ with respect to wastewater generation and disposal practices. The plants can be grouped as follows:

a) Those with no industrial wastewater discharge;

b) Those that discharge solely to a publicly owned sewage treatment plant;

c) Those that discharge directly to a surface watercourse.

Group (c) can be further subdivided into the following:

i) Those with a direct discharge of process, storm and

cooling water to surface water courses, including lakes, rivers, ponds, streams, reservoirs, swamps, marshes or surface drainage works;

ii) Those with a direct discharge of only storm or cooling water to a lake, river, pond, stream, reservoir, swamp, marsh or provincially owned surface drainage works;

iii) Those with a direct discharge of only storm or cooling water to a municipally owned surface drainage works.

For the purpose of this development document, the metal casting sector includes only those plants in groups (c) (i) and (ii).

Industries in group (a) were excluded since they do not produce industrial wastewater. Industries in groups (b) and (c)(iii) are excluded from this sector since they are included in the MISA sewer use program.

The MISA sewer use program will regulate the discharge of industrial wastewater into municipal sanitary sewers and surface drainage works. Group (c)(i) includes some industries which discharge process wastewater into municipal surface drainage works, however, these industries are included in the metal casting sector, since, it is likely that process wastewater will require the same level of treatment and be subjected to the same limits regardless of whether it is discharged directly to a river, pond etc. or through surface drainage works to a river, pond etc.

Of the 300 or so metal casting plants surveyed, approximately 175 fall into group (a) (no industrial discharge), 100 into group (b) (indirect dischargers) and 25 into group (c) (direct dischargers). Of the 25 in group (c), twelve plants fall under groups (c)(i) or (ii). These plants currently form the metal casting sector.

The twelve plants are as follows:

Acustar Canada Inc. - Etobicoke

The Bowmanville Foundry Co. Limited - Bowmanville

Canron Inc., Pipe Division - Hamilton

Fahramet Steel Castings, Indusmin Division of Falconbridge Limited - Orillia

Ford Motor Company of Canada Limited - Windsor

Franklin Electric of Canada Ltd - Strathroy

General Motors of Canada Limited - St. Catharines

Haley Industries Limited - Haley

Magalloy Ltd - Stratford

Richmond Die Casting Ltd - Cornwall

A. H. Tallman Bronze Company Ltd - Burlington

Western Foundry Company Limited - Wingham

These twelve plants belong to the following Standard Industrial Classifications (SIC):

332 - Iron and Steel Foundries

336 - Non-Ferrous Foundries (Castings)

III PRODUCTS

The range of products manufactured by the metal casting sector is extremely large. Products range from large industrial machine parts weighing several tonnes to small electrical components weighing a few grams. These products are made from various metals including steel, malleable iron, ductile iron and grey iron in the ferrous category and aluminum, copper, magnesium and zinc and their associated alloys in the non-ferrous category.

Some of the more notable products include automotive engine and transmission parts, aircraft parts, pumps, pipes and pipe fittings, industrial machine parts, construction materials, railway parts, agricultural equipment, electrical components and tools.

IV PROCESSES

In any given metal casting operation, there are several basic processes. Metal must be heated to a molten state, introduced into a mold, removed from the mold and finished into the final product.

Many melting techniques are used including cupola furnaces, electric arc furnaces, induction furnaces, reverberatory furnaces and crucible furnaces. The type of furnace depends on the metal charge and desired end product.

A cupola furnaces consists of a refractory lined vertical cylinder. Alternate charges of metal, coke and limestone are introduced to the cupola from the top. Combustion air for the coke is supplied at the bottom. The burning coke provides the heat to melt the metal charge. Molten metal and slag are removed from the bottom of the cupola. Slag is usually dropped into water for rapid cooling and granulation. Air emissions from cupolas consist of metal

particulate, coke, limestone, ash, sulfur compounds and carbon monoxide. Cupola furnaces are normally used to produce iron products.

Electric arc furnaces generate heat by producing an electric arc between electrodes. The electrodes are generally made from carbon. The extreme heat generated at the arc makes this type of furnace suitable for ferrous metals only. Air emissions consist of metal fumes, smoke generated by impurities in the metal charge and carbon monoxide from the oxidized electrodes.

Induction furnaces generate heat by inducing eddy currents to flow within the metal from an external alternating current. Since no fuel is used and no direct contact takes place, metal contamination does not occur. These furnaces are used for high quality ferrous and non-ferrous products.

In a reverberatory furnace, a flame is maintained over the charge in a shallow refractory lined vessel. The heat radiates from the walls and roof of the vessel to the charge. Combustion products, metal fumes and smoke are generated as air contaminants.

Crucible furnaces consist of a crucible made from refractory materials and an outer shell. Combustion of a fuel takes place between the crucible and outer shell to provide the heat. These furnaces are used to melt low melting point metals. Air contaminants consist of combustion products and metal fumes.

Molten metal is shaped by introducing it into a mold. The mold essentially consists of two components; the outer mold itself and an internal core used to produce cavities within the final finished product.

Several different molding techniques are used in the industry. In general, the molding techniques can be divided into permanent and non-permanent processes. Permanent processes are those in which the mold is not destroyed in the casting process and include centrifugal casting, die casting, ceramic mold casting, permanent mold casting and direct chill casting. Non-permanent techniques are those in which the mold is destroyed during the casting process and includes sand casting, investment casting and full mold casting.

With permanent processes, the molds are made of ceramics or water cooled metals capable of withstanding the heat of the molten metal. To ensure that the molten metal flows into the mold and is easily removed, lubricants or release agents are used. These agents may be waxy substances or silicates and are usually re-applied to the mold after each cast.

The process of die casting involves the introduction of the molten metal under external forces into a water cooled die. This casting technique is applied to non-ferrous metals such as aluminum

and zinc. Die casting operations are mostly automated and can produce large amounts of precise castings, quickly.

In centrifugal casting, metal is fed into a rotating mold. Centrifugal forces cause the metal to flow outward and take the shape of the mold. Hollow castings such as pipes are produced by this method.

The most common non-permanent casting technique used in the industry is sand casting. With this technique, sand is formed around a pattern. The pattern is removed and molten metal is poured into the cavity left by the pattern. Cores may also be used to produce cavities within the casting itself. After the metal solidifies, the sand is broken away and often recycled.

In order to make the sand rigid and retain the pattern shape, various agents are used as binders. Numerous trade names are used in the industry to describe various modification of the basic sand molding technique. In general, the molding processes are: "green sand" molding, dry sand molding, cold set molding and heat set molding.

Green sand molding refers to the process where water is used to moisten a sand mixture. Additives to the sand may include clay and an organic compound known as "sea" coal. The resulting mold has little strength, thus, cannot be used for castings where a high degree of precision is required.

Dry sand molding utilizes binders that harden upon drying. Such compounds as pitch, gilsonite, cereal, molasses, dextrin, gluten and some natural resins are included in this category. Also included in this category is sodium silicate which hardens with the application of carbon dioxide. Molds or cores produced by this method have high strength.

"No-bake" or cold set molding techniques use a chemical binder with a catalyst to activate the curing process. As the name implies, this process does not require heat. Catalysts can be liquids or solids which are mixed with sand prior to mold forming or gases applied to molds or cores after shaping. Cold set resins employed in the industry include furan resins with an acid catalyst such as phosphoric acid, a furan/peroxide mixture with sulfur dioxide gas used as a catalyst and polyurethane based resins with amine catalysts.

Heat set, "hot box" or "shell" molding techniques utilize thermosetting resins. Typically this process is used to manufacture cores due to the strength of the binder. Shell molding machines are very common at most sites. These machines maintain a heated metal pattern on which resin coated sand is applied. The sand quickly forms a thin rigid shell around the pattern. Two such shells can then be bonded together to form a hollow mold. Shell molds are

both strong and precise. The binder used is commonly a phenolic based resin although thermosetting furan resins are also used. Urea and furfuryl alcohol can be added to phenolic based resins to enhance their properties.

Another non-permanent casting technique used is "full" mold or "evaporative" casting. In this process, a pattern made of polystyrene is placed within a sand mold. The molten metal then burns the pattern out and fills the vacant cavity. A slight variation of this process is investment casting which uses a wax pattern which is melted out prior to introduction of the metal. These casting techniques are extremely accurate.

Metal casting plants utilizing sand must have some type of sand handling system. In small foundries, sand may be delivered in bags and handled manually. In large foundries, sand handling systems can be quite elaborate. Facilities for sand handling include receiving, conveying, mixing, washing, cooling, screening and possibly thermal reclamation. All of these processes generate dust which must be controlled.

In addition to the basic casting processes, metal casting plants also have various related processes. Castings must be cleaned, excess parts removed, machined to final dimensions and inspected for flaws. Castings may be rapidly cooled using water quenches or heated in annealing ovens to alter metallic properties. Surface treatment operations such as acid cleaning or chrome coating are often employed. Dye penetrants are often used for quality control.

Any given metal casting plant may contain some or all of the processes identified above. Manufacturing facilities located at the same site as metal casting operations are considered captive under the metal casting sector. In a similar manner, casting operations associated with iron and steel works or mining operation are captive under those sectors and excluded from the metal casting sector.

V WASTEWATER

Wastewater in the metal casting sector can be classified as process wastewater, non-contact cooling water, storm run-off and sanitary wastewater.

Process wastewater by definition is water that comes in direct contact with process materials or by-products of the operation. Process wastewater will therefore be contaminated by these products. In the metal casting sector, process wastewater may be generated during cast quenches, slag quenches, cast cleaning operations, sand washing operations, surface treating and coating operations, quality control processes and from scrubbers used to control air contaminants. Scrubbers are used to control dust, smoke and fumes generated from melting and pouring operations, sand handling processes, cast cleaning and grinding operations and

generally anywhere air pollution may be a problem. In general, scrubber wastewater is the largest source of process wastewater in most complex foundries.

Cooling water by definition does not directly contact the process. This water is circulated within a contained heat transfer system. Recirculating systems with cooling towers, ponds or holding tanks are often used. This necessitates the use of water conditioning chemicals to prevent fouling by slime growth, corrosion or precipitation of metals. Once through cooling water may also require conditioning if raw water quality is poor.

Cooling water is used to cool furnaces, cupolas, shell molding machines, die casting machines and dies, centrifugal molding machines, permanent molds, continuous casting dies and air compressors. This water should not be contaminated by process materials, however, it may become contaminated by heat exchanger leaks or spills to the collection system.

Scrap metal, new and used foundry sand, coke, limestone, process materials, cast products and other materials may be stored outside. Storm water run-off may therefore be a source of contamination.

Storm sewer collection systems may include floor drains within the plant allowing spills, floor washings, tank overflows and other sources of pollution to enter the storm water collection system. Connections, for the purpose of discharging industrial wastewater, may be made to down spouts from roof drains.

Metal casting plants which do not have access to municipal sanitary sewers may have on-site sanitary sewage works which discharge to a receiving stream. These biological treatment plants may also be used to treat biodegradable industrial wastes. The effluent from these plants may therefore contain industrial contaminants.

VI WASTEWATER CONTROL

Contaminants historically associated with metal casting plants include suspended solids from foundry sands, phenolics from resin binders, metals from raw materials and oil and grease from hydraulic oils, machining fluids and contaminated charge metals. If surface treating and coating operations are employed, acids and chromates will be present.

Treatment of process wastewater in the industry includes chemically aided settling of solids in clarifiers, surface ponds to float oil and grease and batch treatment of metals, acids and chromates. Metals are precipitated as hydroxides, acids neutralized and hexavalent chromium reduced to trivalent and precipitated as a

hydroxide.

Treatment at any given site has not been complete. This has resulted in exceedences of provincial industrial discharge objectives and certificate of approval requirements for phenols, solids and some metals at various sites within the sector.

Recent initiatives in the industry have included the upgrading of suspended solids removal equipment, the treatment of high strength phenolic streams using fixed film biological processes, the installation of batch treatment systems designed with the flexibility to handle various treatment needs and general enhanced housekeeping practices to reduce water usage and eliminate unnecessary waste streams.

Smaller industries in the sector typically discharge process wastewater to the municipal sanitary sewer leaving only cooling and storm water to be discharged directly. This eliminates the need for expensive on-site treatment works.

VII THE METAL CASTING SECTOR INDUSTRIES

The metal casting sector in Ontario contains twelve plants which have been identified as direct dischargers. These twelve plants vary in size, use different processes and produce different products.

The following provides a brief description of the industries in this sector. Six of the plants discharge process wastewater. The remaining six discharge only cooling or storm water.

A. Acustar Canada Inc - Etobicoke

Employees	-	450
Products	-	automotive parts
Metals	-	aluminum
Melting Techniques	-	reverberatory furnaces
Molding Methods	-	die casting and permanent molding
Raw Water	-	municipal
Wastewater	-	cooling, storm
Treatment	-	none
Final Effluent	-	1200 m^3/d (estimate)

Discharge Point	-	creek to Lake Ontario

B. The **Bowmanville Foundry Co. Limited - Bowmanville**

Employees	-	62
Products	-	agricultural and construction equipment
Metals	-	malleable iron
Melting Techniques	-	induction furnaces
Molding Methods	-	sand
Raw Water	-	municipal
Wastewater	-	cooling water from induction furnaces
	-	storm water
Treatment	-	none
Final Effluent	-	140 m^3/d
Discharge Point	-	Bowmanville Creek to Lake Ontario

C. **Canron Inc., Pipe Division - Hamilton**

Employees	-	270
Products	-	pipe
Metals	-	ductile iron
Melting Techniques	-	cupola, induction furnaces
Molding Methods	-	continuous, centrifugal, shell sand
Raw Water	-	municipal
Wastewater	-	cupola scrubber tank overflow, slag quench tank overflow, cement lining process wastewater
	-	cooling, storm
Treatment	-	solids removal for cement wastewater and scrubber wastewater
Final Effluent	-	75 m^3/d (estimate)

Discharge Point	-	storm ditch to Hamilton Harbour.

D. Fahramet Steel Castings, Indusmin Division of Falconbridge Limited - Orillia

Employees	-	240
Products	-	industrial equipment parts
Metals	-	steel
Melting Techniques	-	electric arc and induction furnaces
Molding Methods	-	centrifugal, shell sand, cold set sand, green sand
Raw Water	-	municipal
Wastewater	-	quench tank, mold wash tank overflow
	-	cooling, storm
Treatment	-	cooling pond
Final Effluent	-	130 m^3/d (estimate)
Discharge Point	-	cooling pond overflow to storm ditch to Lake Simcoe.

E. Ford Motor Company of Canada Limited - Windsor

Employees	-	1000
Products	-	automotive parts
Metals	-	nodular and grey iron
Melting Techniques	-	cupolas
Molding Methods	-	green sand, shell sand
Raw Water	-	Detroit River
Wastewater	-	dust collectors, slag quench
	-	cooling, storm
Treatment	-	suspended solids removal by clarification, oil lagoon

Final Effluent	-	90,000 m^3/d
Discharge Point	-	Detroit River

F. **Franklin Electric of Canada Ltd - Strathroy**

Employees	-	200
Products	-	electrical equipment
Metals	-	aluminum
Melting Techniques	-	reverberatory furnaces
Molding Methods	-	die casting
Raw Water	-	on-site wells
Wastewater	-	cooling water from air compressors, die casting machines and hydraulic systems on milling machines
	-	quench tank and phosphate rinse tank overflows
	-	storm
Treatment	-	aerated cooling pond
Final Effluent	-	unknown
Discharge Point	-	cooling pond overflow to creek to Sydenham River

G. **General Motors of Canada Limited - St. Catharines**

Employees	-	2500
Products	-	automotive parts
Metals	-	nodular and grey iron
Melting Techniques	-	cupolas, electric induction furnaces
Molding Methods	-	green sand, heat set sand, cold set sand, shell sand
Raw Water	-	Welland Canal
Wastewater	-	dust collectors
	-	cooling, storm

Treatment	-	suspended solids removal by clarification, oil lagoon, biological oxidation for phenols
Final Effluent	-	130,000 m^3/d
Discharge Point	-	Welland Canal.

H. Haley Industries Limited - Haley

Employees	-	413
Products	-	aerospace parts
Metals	-	aluminum, magnesium
Melting Techniques	-	crucible furnaces
Molding Methods	-	heat set sand, cold set sand
Raw Water	-	neighboring mine
Wastewater	-	dust collectors, acid and chromate baths, fluorescent dye penetrant, SO2 scrubber
	-	cooling, storm
Treatment	-	settling, acid neutralization, chromate reduction, biological oxidation for penetrating oils, SO2 precipitation
Final Effluent	-	600 m^3/d
Discharge Points	-	two process sewers to McLaren Creek.

I. Magalloy Ltd - Stratford

Employees	-	38
Products	-	pumps and valves
Metals	-	steel
Melting Techniques	-	induction furnaces
Molding Methods	-	sand
Raw Water	-	municipal

Wastewater	-	cooling for induction furnaces and equipment for thermal reclamation of sand
Treatment	-	none
Final Effluent	-	unknown
Discharge Point	-	creek

J. Richmond Die Casting Ltd - Cornwall

Employees	-	125
Products	-	custom products, mainly automotive parts
Metals	-	aluminum
Melting Techniques	-	reverberatory furnaces
Molding Methods	-	die casting
Raw Water	-	municipal
Wastewater	-	cooling for die casting machines and air compressors
Treatment	-	none
Final Effluent	-	1500 m^3/d (estimate)
Discharge Point	-	Frazer Creek to St. Lawrence River

K. A. H. Tallman Bronze Company Ltd. - Burlington

Employees	-	25
Products	-	valves, fittings and gears
Metals	-	copper based
Melting Techniques	-	crucible furnaces
Molding Methods	-	centrifugal and sand
Raw Water	-	municipal
Wastewater	-	cooling for centrifugal molds and air compressors

Treatment	-	none
Final Effluent	-	25 m^3/d
Discharge Point	-	creek to Lake Ontario

L. **Western Foundry Company Limited - Wingham**

Employees	-	300
Products	-	automotive parts
Metals	-	grey iron
Melting Techniques	-	induction furnaces
Molding Methods	-	sand and heat set sand
Raw Water	-	municipal
Wastewater	-	cooling for induction furnaces, air compressors and shell core machine
Treatment	-	none
Final Effluent	-	2000 m^3/d (estimate)
Discharge Point	-	Maitland River

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PART II

THE TECHNICAL RATIONALE FOR THE EFFLUENT MONITORING REGULATION - METAL CASTING SECTOR

PART II - THE TECHNICAL RATIONALE FOR THE EFFLUENT MONITORING REGULATION - METAL CASTING SECTOR

I INTRODUCTION

The Effluent Monitoring Regulation for the Metal Casting Sector is designed to provide an accurate and credible account of priority and conventional pollutants being discharged from this industrial sector. This information is required in order to develop effluent limits for this sector. In developing the regulation, many approaches and options were considered for use. This section provides the technical rationale for the adopted approach.

The regulation was developed by the Ministry in consultation with representatives from the metal casting industry, Environment Canada and the Ministry of Industry, Trade and Technology and is intended to collect effluent data for the development of a subsequent effluent limits regulation.

The monitoring regulation was developed using data from pre-regulation monitoring studies undertaken by selected industries and the Ministry of the Environment (MOE) and existing monitoring data. Due to economic restraints, all plants within the sector were not monitored, however, the pre-regulation monitoring program included all major wastewater generators and a good cross-section of the processes and materials used in the sector. The data is therefore representative of the industry as a whole.

II THE NEED FOR REGULATION

The goal of the MISA program is to reduce and ultimately eliminate the discharge of toxic chemicals into surface waters. This will be achieved in various stages. Initially, effluent limits will be set for nine industrial sectors and the municipal sector based on discharge levels obtainable by the use of Best Available Technology Economically Achievable (BAT EA). In order to develop these limits for the metal casting sector, an accurate and credible account of what is currently being discharged from this sector is required.

Existing monitoring data in this sector was reviewed and considered for use, however, it was concluded that this data, while being useful for monitoring regulation development, was insufficient for the development of a limit setting regulation.

The majority of the existing monitoring efforts have been geared at estimating monthly average loadings of conventional parameters from major industries within the sector. Other data consists of periodic spot checks performed by the Provincial and Municipal governments for a few conventional parameters. Some priority pollutant data exists from Environment Canada's efforts with the Upper Great Lakes Connecting Channels Study and U.S.

EPA studies.

A comprehensive monitoring program is therefore required to supplement existing monitoring data for conventional parameters and to determine the levels of priority pollutants being discharged from the Ontario metal casting industry. (Data sources used are listed in Appendix A.)

III THE U.S. EPA'S APPROACH

The U.S. EPA (17) studied the metal casting industry during the 1970's and 1980's and subsequently promulgated effluent regulations for the Metal Molding and Casting Point Source Category in October 1985. The pre-regulation development studies included process and raw material reviews and sampling for 30 conventional and 129 priority pollutants.

The U.S. EPA metal molding and casting sector was divided into five industrial categories and 31 process subcategories for study purposes. The five industrial categories were based on the following metal groups: aluminum, copper, ferrous metals, magnesium and zinc. The regulation, however, specifies limits for only four industrial categories including 28 process subcategories. The magnesium industry was excluded for economic reasons. The industrial categories/process subcategories are as follows:

Aluminum

Casting Cleaning Operations
Casting Quench Operations
Die Casting Operations
Dust Collection Scrubber Operations
Grinding Scrubber Operations
Investment Casting
Melting Furnace Scrubber Operations
Mold Cooling Operations

Copper

Casting Quench Operations
Direct Chill Casting Operations
Dust Collection Scrubber Operations
Grinding Scrubber Operations
Melting Furnace Scrubber Operations
Investment Casting
Mold Cooling Operations

Ferrous

Casting Cleaning Operations
Casting Quench
Dust Collection Scrubber Operations

Grinding Scrubber Operations
Investment Casting
Melting Furnace Scrubber Operations
Mold Cooling Operations
Slag Quench Operations
Wet Sand Reclamation Operations

Zinc

Casting Quench Operations
Die Casting Operations
Melting Furnace Scrubber Operations
Mold Cooling Operations

The U.S. EPA regulation specifies Best Available Technology (BAT) effluent limits for pH, total suspended solids, oil and grease, total phenolics (4AAP), copper, lead and zinc. BAT limits for the four categories are formulated on maximum recycling, oil skimming for oil and grease reduction, chemical oxidation using potassium permanganate for phenol reduction, lime addition and settling for metals and solids control and filtration for metals and solids polishing. It is important to note that toxic organics are not directly regulated. The U.S. EPA concluded that toxic organics can be controlled by controlling oil and grease levels, since, toxic organics found in this sector have a higher affinity for oil and grease than water.(17)

As an alternate to using oil and grease as a surrogate, the U.S. EPA specifies limits for total toxic organics (TTO) as pretreatment standards for new and existing sources (PSNS and PSES). These limits are based on the "long-term average treatment effectiveness concentration" (LTATEC) which represents the average concentration achievable by implementing BAT. The TTO limits for each subcategory were determined by,

- summing the LTATEC for each of the pollutants detected above the treatable limit in raw wastewater from that subcategory, and then,

- applying statistically determined variability factors to arrive at the maximum one day limit and maximum monthly average.

A list of the LTATECs for all compounds that make up TTO in the various subcategories is presented in Table 1, Appendix B.

A complete summary of the U.S. EPA program is presented in the EPA Development Document for Effluent Limitations, Guidelines and Standards for the Metal Molding and Casting (Foundries) Point Source Category (17). This document provides extensive background information on the metal casting industry and includes,

- a summary of the processes used in the sector,

- a summary of the compounds detected in metal casting process effluent and the concentrations at which these compounds were detected, and

- recommendations for which parameters require effluent limits.

This information was used extensively in developing the effluent monitoring regulation for the Ontario metal casting sector. The information was used,

- as background process information,

- to identify which compounds may be present in metal casting effluent,

- to identify which compounds my exceed treatable limits, and

- to form a core set of parameters which need to be assessed as candidates for control limits.

Adoption of the U.S. EPA regulatory requirements was not considered appropriate since,

- the effluent limits are based on process subcategories. These limits may not reflect the effluent quality achievable by centralized treatment systems which are employed in Ontario metal casting sector plants,

- the effluent limits in some cases are based on information that is not readily available, e.g. scrubber air flow rates, and

- raw materials and water usage may differ in Ontario.

IV REGULATORY APPROACH

In developing the MISA monitoring regulation for the sector, two approaches were considered; a site-specific approach and a general approach. A site-specific approach was selected since it could best account for the diversity in size and water usage practices in the industry.

In developing the site-specific monitoring requirements for each direct discharger, the following items were considered:

- The nature of the processes contributing to the wastewater stream;

- The expected characteristics of the wastewater stream; and

- The magnitude and potential environmental impact of the wastewater stream.

The metal casting sector regulation contains twelve site-specific monitoring schedules, one for each plant listed in Section I of this development document.

V SAMPLING LOCATIONS

A review of all metal casting plants within the sector identified the following classes of effluent streams:

- Process;

- Cooling water; (Note: Some cooling water effluent streams may contain **small** quantities of process effluent which routinely spills or is discharged into the cooling water collection system via floor drains. These streams are considered as cooling water effluent streams for the purpose of applying the General Regulation. However, for the purpose of developing the site-specific monitoring requirements, these streams are given special consideration. Designation of these streams as process or combined effluent streams is not considered appropriate since these streams contain process effluent that is significantly diluted by clean cooling water. Data generated from the monitoring of these streams is not representative of process effluent and therefore, could not be used to generate meaningful limits. Under the limits regulation, these streams will be dealt with,

    - by applying best management practices to eliminate the process sources, and/or

    - by applying effluent limits, generated by monitoring other similar process effluents, to the process component of these streams.)

- Storm water run-off from contaminated areas;

- Sanitary;

- Combined; (Note: Combined effluent streams contain

at least one well defined process effluent stream plus cooling water or storm water. Combined effluent streams may also contain process wastewater which is discharged directly into the combined effluent stream.)

- Combined storm water and cooling water streams.

In selecting the most suitable sampling point for each effluent stream, the following criteria were used:

1. The sampling point should be located at a point on the effluent stream prior to dilution by other streams;

2. The sampling point should identify the origin of any pollutant; and

3. The overall number of sampling points for each plant should be kept to a minimum.

Using the above criteria, the following sampling locations were selected:

- Process effluent streams after final treatment, if any, but prior to dilution and mixing with other streams. If a well defined process effluent stream does not exist because a combined collection system is used, the combined stream must be monitored in accordance with the requirements for process effluent streams.

- Cooling water effluent streams after all floor drain connections but prior to dilution by other streams.

- Storm water run-off prior to dilution by other streams.

- Combined effluent streams downstream of the final effluent stream addition point.

- Combined storm water and cooling water streams downstream of the final effluent stream addition point. These streams are to be monitored only if separate storm water and cooling water streams are not available because a combined collection system is used. In this case, the combined stream is subject to the monitoring requirements for both storm water and cooling water.

VI FLOW MEASUREMENT

The General Regulation describes the requirements for flow measurement for the various classifications of effluent streams. These requirements were considered for use in the Metal Casting Sector and found to be applicable.

Process effluent streams which are to be monitored, are required to be continuously measured by devices with an accuracy of plus or minus 15% of the actual flow if existing equipment is used and plus or minus 5% of actual flow for the primary device and plus or minus 2% of full scale flow for the secondary device if new equipment is to be purchased.

Combined process effluent streams which are to be monitored, are required to be continuously measured by devices with an accuracy of plus or minus 20% of actual flow.

Storm water and cooling water effluent streams which are to be monitored, are required to be measured or estimated within plus or minus 20% of actual flow at the time of sampling.

VII PRE-REGULATION MONITORING

Pre-regulation monitoring studies were undertaken by selected industries in the sector to provide a basis from which the effluent monitoring regulation could be developed. The plants which voluntarily partook in the pre-regulation monitoring program were,

- Acustar Canada, Etobicoke,
- Ford Motor Company, Windsor,
- General Motors, St. Catharines, and
- Haley Industries, Haley.

Acustar monitored the storm sewer system effluent which included all cooling water, Ford and General Motors monitored both foundry process and combined effluent which included their engine plant wastewater and Haley Industries monitored all process effluent streams.

The monitoring program for each effluent sampling point consisted of three 24 hour composite samples taken on separate operating days. The samples were analyzed for conventional parameters and priority pollutants. Table 3, Appendix B summarizes the priority pollutants that were analyzed for each sample. Table 4, Appendix B summarizes the frequency of detection of these compounds. Table 5, Appendix B summarizes the number of organic compounds detected in each analytical test group for each effluent

stream. Table 6, Appendix B lists the organic compounds detected above the LTATECs.

The pre-regulation monitoring program played an important role in the development of the monitoring strategy. Pre-regulation monitoring results were used as follows:

1. Data was compared to existing monitoring data for conventional parameters to evaluate the representativeness of the existing data. This comparison confirmed the persistent problem with high levels of phenols and suspended solids in foundry process effluent.

2. Data was used to evaluate which parameters are of concern in this sector.

3. Data was used to identify which compounds require further study in the metal casting sector.

4. Data was used to identify compounds not currently listed on the Effluent Monitoring Priority Pollutant List (EMPPL). These compounds are now undergoing review to determine whether or not they meet the criteria for addition to EMPPL.

VIII MONITORING STRATEGY - GENERAL RULES

The goals of the metal casting sector MISA monitoring program are to,

- accurately quantify the concentrations and mass loadings of those contaminants that will be assessed as candidates for control limits,

- estimate the concentrations and mass loadings of contaminants that are known to be present but not considered as candidates for control limits at this time,

- identify and semi-quantify the concentrations and mass loadings of other toxic contaminants that may be present, and

- evaluate the toxicity of metal casting effluent.

In developing the monitoring strategy for the metal casting sector, some general rules were followed. These rules were developed to ensure that the goals of the monitoring program were achieved. The general rules are as follows:

1. The monitoring principles specified in the General Regulation will be applied where possible.

2. Existing monitoring data including pre-regulation monitoring data will be used where possible to justify parameter selection and monitoring frequency. In the absence of supporting data, best professional judgement will be used.

3. An approach consistent with other Sectoral Effluent Monitoring Regulations will be used, if applicable.

4. All metal casting effluent streams will be monitored. The monitoring requirements for each stream will be a function of the origin of the stream.

5. Process effluent streams will be monitored for all priority pollutants and most conventional parameters associated with industrial effluents.

6. Cooling water effluent streams will be monitored for parameters that will identify that contamination is occurring and quantify the severity of any such contamination.

7. Storm water effluent streams will be monitored for parameters that will identify that contamination is occurring and quantify the severity of any such contamination.

8. Combined effluent streams, being the sum of process effluent and cooling water and/or storm water, will be reviewed for each site. Monitoring requirements will be a function of the parameters that may contaminate the effluent and the monitoring requirements imposed on the streams that contribute to the combined stream.

9. For process effluent streams, the monitoring frequency for each parameter will be a function of the parameter type, the parameter concentration and the desired information needs.

    (a) Frequent routine monitoring (e.g. daily, thrice weekly) will be required for parameters that will be assessed as candidates for control limits or are process monitors.

    (b) Less frequent routine monitoring (e.g. monthly) will be required for parameters that are known to be present but will not be assessed as candidates for control limits.

    (c) Monitoring will be required to determine presence/absence of other toxic compounds.

10. Monitoring for priority pollutants will be on an analytical test group basis, i.e. if a compound requires monitoring at a certain frequency, the entire analytical test group containing that compound will be monitored at that frequency.

11. Toxicity testing will be required for all process and combined effluent streams that are discharged directly to a surface watercourse.

The monitoring frequencies selected for use in the metal casting sector include daily, thrice weekly, weekly, monthly and quarterly. Daily, thrice weekly and weekly monitoring will be used to accurately quantify loadings. Monthly monitoring will be used to estimate yearly loadings and quarterly monitoring will be used to determine presence/absence of toxic contaminants. Storm and cooling water will be monitored monthly and quarterly.

The selection of these frequencies was statistically based. A summary of the statistical rationale is provided below.

It is anticipated at this time, that, effluent limits will be based in part on monthly averages, since, this is consistent with other regulatory approaches (17), it accounts for seasonal variances and is based on the natural division of the calendar year. To determine the number of samples required to calculate monthly averages, classical statistical methods are used. The number of samples is a function of the specified relative error, desirable significance level and variability of the contaminant. Sample results will vary for many reasons including, process fluctuations, sampling errors, laboratory errors and others. To quantify this variability, the coefficient of variation, defined as the standard deviation divided by the mean, is used. The number of samples required to calculate the monthly mean with a relative error of 25% at the 95% significance level was investigated by Ministry staff (14). Parameters with coefficients of variation of 0.7, 0.5 and 0.25 require 30, 15 and 4 samples per month respectively, to determine the monthly mean within the specified limits. Based on these required number of samples, daily, thrice weekly and weekly monitoring frequencies were selected for use.

In order to estimate yearly loadings for conventional parameters known to be present but at low concentrations and priority pollutants, monthly monitoring is required. This will generate twelve data points a year which will be used to estimate the yearly loadings of these contaminants and provide a data base for future study. These results will be considered in selecting control technologies and developing monitoring requirements for the subsequent limits regulation. The results will also be used for inter sector comparisons of loadings.

When compounds are not present or measurable all the time, statistical methods must be used to ensure, with a high degree of confidence, that a compound will be detected if in fact it is present in measurable amounts. By applying the binomial probability distribution in which the probability of detecting a compound in any given sample is p and the probability of failing to detect the compound is q, the probability that at least one sample will show the presence of the compound in n samples is

$$p(\text{at least one detection}) = 1 - q^n .$$

Table 2, Appendix B shows the probability of detecting at least once, the compound in 2, 4, 6, 8, 10 and 12 characterizations for various values of p and q. For a given parameter that is present 50% of the time or greater in an effluent, the probability of finding the contaminant is 98.4% with six characterizations, 93.7 % with four characterizations, etc. This regulation specifies four complete characterizations for determining presence/absence. This frequency, in conjunction with pre-regulation monitoring, ensures that if a compound is present 50% of the time in metal casting effluent, it will be identified with a probability of greater than 99%. A summary of the number of pre-regulation characterizations is given in Table 3, Appendix B.

IX MONITORING STRATEGY - SPECIFIC RULES AND PARAMETER/FREQUENCY ASSIGNMENT

In selecting a suitable monitoring frequency for each group of contaminants, the following approach was adopted:

1. A set of selection rules were developed for each monitoring frequency.

2. Each parameter was evaluated with respect to,

    - origin,
    - variability,
    - concentration,
    - presence/absence characteristics,
    - required information needs, and
    - existing monitoring practices.

3. The selection rules were applied to each parameter to determine a suitable monitoring frequency.

For process effluent streams, the regulation typically specifies monitoring for four parameters daily, as many as six parameters thrice weekly, as many as five parameters weekly and as many as fourteen parameters or groups of contaminants (108 compounds) monthly. Biomonitoring is required on a monthly basis. Characterization and open characterization are required quarterly. A summary of the chemical monitoring requirements for streams

containing process effluent is given in Table 8, Appendix B. Characterization, open characterization and biomonitoring are discussed in separate sections following the discussion on routine chemical monitoring.

Cooling water is required to be monitored for as many as six parameters, at a frequency of once per month. Storm water is required to be monitored for as many as seven parameters, also at a frequency of once per month. Storm water and cooling water will be monitored quarterly for polychlorinated biphenyls.

The selection rules and parameters selected for each monitoring frequency are discussed below.

A Process Effluent Streams

i) Daily

The parameters chosen for daily monitoring are conventional parameters that,

- are indicators of process upsets or variability,
- are measures of treatment effectiveness,
- are currently monitored at this frequency, or
- will be assessed as candidates for control limits.

Parameters which are considered indicators of process upsets or variability are required to be monitored daily to ensure continuous monitoring of the day to day plant activities. The results will be used to interpret the representativeness of data obtained on a less frequent basis. Continuous on-line analyzers are preferred to daily composites for these parameters since this will allow for recording of instantaneous peaks.

Parameters which are measures of treatment process effectiveness are required to be monitored daily to provide an accurate data base from which BAT EA limits may be derived. In many cases these parameters are already monitored daily as an operating control for the treatment process.

Parameters that,

- are currently regulated by MOE at foundry sites,
- are regulated by U.S. EPA in this sector, or
- may exceed current Provincial Objectives,

will be assessed as candidates for control limits.

Parameters which will be assessed as candidate for setting control limits require daily monitoring if significant fluctuations occur on a daily basis. If a data base exists, the coefficient of variation may be used to measure the degree of fluctuation and justify the monitoring frequency. Parameters with true (i.e. based on a large population) coefficients of variation above 0.5 require daily monitoring to quantify the monthly mean within the previously stated limits for relative error and significance level of 25% and 95% respectively. If only a limited data base exists, the calculated coefficient of variation is not truly representative and therefore, may be used as a guide only. Existing data bases in this sector are generally small or contain only grab sample results which can not be compared to daily composites. Therefore, when using this criterium to select the parameters for daily monitoring, the calculated coefficient of variation and best professional judgement is used. When several values of the calculated coefficient of variation are available, the highest value is considered appropriate since it represents the worst case. Using this approach, errors in monitoring frequency selection will yield more accurate results. A summary of the calculated coefficient of variations for several conventional parameters is presented in Table 7, Appendix B. This data is based on Environment Canada's efforts with the UGLCCS at Ford's Windsor Casting Plant (3).

The coefficient of variation for each parameter, while being based on the monitoring results from one plant, was assumed to apply to other foundries in the sector. This assumption is considered appropriate, since, the processes that generate the contaminants studied are similar for each foundry.

Metal casting plants will monitor process effluent streams daily for hydrogen ion (pH), specific conductance, total suspended solids and total phenolics (4AAP). The rationale for including these parameters is as follows:

Hydrogen Ion (pH)	-	regulated by U.S. EPA(17) and MOE(7);
	-	indicator of process upsets and variability;
	-	control parameter for soluble metals;
Specific Conductance	-	indicator of process upsets and variability;
	-	indicator of dissolved inorganic salts which may impact on aquatic life.
Total Suspended Solids	-	regulated by U.S. EPA(17) and MOE(5);
	-	measure of suspended solids treatment

		plant performance;
	-	present in high concentrations in foundry raw effluent;
	-	coefficient of variation calculated to be 0.92 based on seven samples taken during one week. (See Table 7)
Phenolics (4AAP)	-	regulated by U.S. EPA(17) and MOE(6);
	-	imparts taste and odour to drinking water;
	-	present in high concentrations in foundry raw wastewater;
	-	coefficient of variation calculated to be 0.95 based on five samples taken during one week;(See Table 7)
	-	typically, treatment required to meet current provincial objectives.

ii) Three Times Per Week

The parameters chosen for thrice weekly monitoring are parameters that,

- will be assessed as candidates for control limits.

Parameters that,

- are currently regulated by MOE at foundry sites,
- are regulated by U.S. EPA in this sector, or
- may exceed current Provincial Objectives,

will be assessed as candidates for control limits.

Parameters that will be assessed as candidates for control limits are required to be monitored on a thrice weekly basis if they fluctuate at a moderate level. Again, if a data base exists, the coefficient of variation may be used to measure the degree of fluctuation and justify the monitoring frequency. Parameters with true coefficients of variation greater than 0.25 but less than 0.5 require thrice weekly monitoring to quantify the monthly mean within the previously stated limits for relative error and significance level of 25% and 95% respectively. If only a limited data base exists, the calculated coefficient of variation is not truly representative and therefore, may be used as a guide only. In

selecting the parameters for thrice weekly monitoring, the calculated coefficient of variation and best professional judgement is used. When several values of the calculated coefficient of variation are available, the highest value is considered most appropriate since it represents the worst case. Using this approach, errors in frequency selection will yield more accurate results.

Metal casting plants will monitor on a thrice weekly basis process effluent and/or combined effluent streams for chemical oxygen demand, ammonia plus ammonium, total metals, hexavalent chromium, fluorides and oil and grease. Ammonia plus ammonium will be monitored at this frequency in site-specific cases where pre-regulation monitoring data suggests that current Provincial Water Quality Objectives may be exceeded for free ammonia. Hexavalent chromium will be monitored at this frequency only if total chromium exceeds one milligram per litre. Fluorides will be monitored at this frequency in site-specific cases where pre-regulation monitoring data and process information suggests that fluorides may be present at levels that may exceed current Provincial Objectives. The rationale for including these parameters is as follows:

Chemical Oxygen Demand	-	a measure of total oxygen demanding material including organic material, reduced metals, refractory (non-biodegradable) compounds and other oxidizable compounds. This parameter is an indicator of the oxygen depletion impact of the effluent on the receiving stream. Biochemical oxygen demand was considered but eliminated because of analytical problems, i.e. laboratories carrying out this test must obtain an acclimated bacterial seed for each industrial effluent;
	-	due to the presence of phenolic compounds and other oxygen demanding materials, foundry effluent may have significant impact on the oxygen levels in the receiving watercourse. As a result of this, COD will be assessed as a candidate for setting limits;
	-	biochemical oxygen demand regulated by MOE(12), therefore, COD as an alternate for BOD should be considered for regulation.
Ammonia + Ammonium	-	may be present at elevated levels in metal casting effluents from the thermal decomposition of resins containing

		nitrogen or from ammonium containing compounds used in the plant;
	-	un-ionized ammonia is toxic to aquatic life at very low concentrations. The fraction of total ammonium that exists as un-ionized ammonia is a function of pH and temperature;
	-	pre-regulation monitoring data reported for some effluents, showed ammonia plus ammonium concentrations at levels which may result in an un-ionized ammonia concentration in the receiving stream in excess of the Provincial Water Quality Objective(13) for un-ionized ammonia. These effluents are required to be monitored thrice weekly. Effluents where ammonia plus ammonium was not detected at high levels and/or which are not expected to contain high levels, are required to be monitored monthly since ammonia plus ammonium will not be evaluated as a candidate for control limits on these streams;
	-	coefficient of variation calculated to be 0.46 based on five samples taken during one week; (See Table 7)
	-	un-ionized ammonia regulated by MOE(7);
Total Metals	-	regulated by U.S. EPA(17) and MOE(7);
	-	always present in metal casting process and combined effluent streams;
	-	coefficient of variation calculated to be a maximum of 0.49 based on thirteen sets of samples for various metals; (See Table 7)
	-	concentrations of individual metals required to design treatment works;
	-	cost of analysis for the complete list of metals is similar to the cost of analysis for one or two metals on the list;
	-	iron and magnesium added to the sector list since they are base metals used in

the industry and may be present in high concentrations. While not considered toxic, these parameters can be used to monitor process metal losses to the environment. These parameters are usually included in metal scans at no additional cost.

Hexavalent Chromium - compounds containing hexavalent chromium are used for the surface treatment of some metals and thus, hexavalent chromium may be present in high concentrations in some effluents. Total chromium is measured thrice weekly as part of total metals. Total chromium analysis measures both trivalent chromium which is not considered toxic and hexavalent chromium which is. If total chromium exceeds one milligram per litre, hexavalent chromium may be present at harmful levels and should be monitored separately.

Fluorides - fluorides may be present in metal casting effluents because hydrofluoric acid baths are used to clean and etch the surface of metal castings, fluoride salts are used as fluxes in melting processes or the decomposition of organic compounds containing fluorine, which are used mold release agents, may result in the generation of fluoride containing compounds;

- pre-regulation monitoring data revealed fluoride levels in some effluents orders of magnitude greater than the current Ontario Drinking Water Objective(8) and Water Quality Criteria for Livestock Watering(13). These effluents are required to be monitored thrice weekly to evaluate this parameter as a candidate for setting limits. Effluents where fluorides were not detected at high levels or which are not suspected to contain high levels of fluorides, are required to be monitored monthly.

Oil and Grease - regulated by U.S. EPA(17) and MOE(7);

- coefficient of variation calculated to be 0.16 based on five samples taken during

one week. This coefficient of variation indicates that less frequent than thrice weekly monitoring is necessary, however, thrice weekly monitoring is required to ensure accurate quantification of this important parameter; (See Table 7)

- indicator of toxic organics being discharged since toxic organic compounds present in metal casting process effluent have a higher affinity for oil and grease than water. U.S. EPA studies in the metal casting sector concluded that control of oil and grease was sufficient to control those toxic organic compounds normally found in metal casting process effluent wastewater (17). Compounds detected in U.S. metal casting plants are similar to those found in Ontario plants with respect to both type and concentration;

- present in effluent in measurable amounts originating from hydraulic oils, cutting fluids, lubricants, etc.

iii) Weekly

The parameters chosen for weekly monitoring are parameters that,

- require estimates of monthly and yearly loadings to fulfill commitments outside of MISA, or

- are normally monitored monthly, however, in special site-specific cases may require more frequent monitoring.

Special site-specific cases arise when,

- pre-regulation monitoring data indicate that the LTATEC may be exceeded for any organic priority pollutant, or

- pre-regulation monitoring data or industrial use of the chemical suggests that the contaminant may be present in undiluted effluent at elevated levels.

These elevated levels are not considered significant enough to exceed current Provincial Objectives, however, monitoring at a frequency greater than monthly is required to develop a significant data base to study the parameter further. Compounds detected

above the LTATEC will not be monitored weekly if a suitable surrogate parameter, which is monitored more frequently is available. Monitoring these parameters at frequencies greater than weekly is not required since these parameters do not meet the criteria for daily or thrice weekly monitoring.

The parameters selected for weekly monitoring are nitrate plus nitrite, total phosphorus, dissolved organic carbon, phenanthrene and naphthalene (from analytical test group 19, base neutral extractables). The rational for including these parameters is provided below.

Nitrate + Nitrite	-	nitrate may be present in elevated concentrations in the effluent when nitric acid bath wastes are discharged. Nitrate may be reduced to nitrite which is a parameter controlled in public water supplies. For industries not using nitric acid baths, nitrate plus nitrite levels are generally below the Ontario Drinking Water Objective of 10 mg/l(8). Monthly monitoring for these streams is sufficient;
	-	levels slightly above the Ontario Drinking Water Objectives were observed during pre-regulation monitoring at one site utilizing nitric acid baths.
Total Phosphorus	-	present in metal casting wastewater;
	-	estimates of monthly loadings are required to meet the commitments of the Canada-United States Great Lakes Water Quality Agreement(4). Weekly grab samples are currently reported for this purpose.
Dissolved Organic Carbon	-	a measure of the total amount of soluble organic carbon. Organic materials used in this industry contain toxic compounds, thus, changes in the DOC level can be used to predict gross changes to the level of toxic organics being discharged;
	-	lower detection limit than total organic carbon make this test more attractive. Also, solids in the wastewater are expected to be mostly inorganic therefore, DOC levels should be similar to TOC levels;

- monitoring at this frequency is required to study organic loading variability.

Base Neutral Extractables

- present in materials used on-site;
- PAH's may be generated by the destructive distillation of sea coal;
- wide variety of compounds detected at concentrations above the method detection limits during pre-regulation monitoring. Phenanthrene and Bis(2-ethylhexyl) phthalate detected in average concentration above the LTATEC. Bis(2-ethylhexyl) phthalate concentration attributed to sample artifact;
- naphthalenes consistently present at concentrations below the LTATECs;
- controlled by oil and grease removal since these compounds have a significantly higher affinity for the oil and grease phase than the aqueous phase (17);
- phenanthrene and naphthalene are indicators of other compounds in this test group. Weekly monitoring for these two compounds is required to study variability and to determine yearly loadings. The entire test group is required monthly.

iv) Monthly

The parameters chosen for monthly monitoring are parameters which are known or likely to be present in metal casting wastewater but are not considered as candidates for setting control limits. These parameters are not considered as candidates for control limits since,

- they were detected during pre-regulation monitoring studies at concentrations below the LTATEC for organic priority pollutants or below the treatable level for metals (note: the treatable level of 10 ug/l was used for analytical test groups in which no LTATECs exist), and/or
- they are controlled by surrogate parameters that are considered as candidates for control limits.

The LTATECs for organic priority pollutants were taken from the U.S. EPA. They are presented in Table 1, Appendix B. Treatable levels were taken from the U.S. EPA as 10 ug/l for organics and 300 ug/l for metals.(note: 300 ug/l is the highest value reported for any metal. Individual metals may have lower treatable levels. The lower levels were used where appropriate.) The treatable levels were considered achievable by carbon absorption and lime addition, settling and filtration, respectively (17).

A summary of the organic compounds detected during the pre-regulation monitoring program is presented in Table 4 and Table 5, Appendix B. A list of the organic compounds detected above the LTATEC is presented in Table 6, Appendix B.

Random monthly sampling will be used to estimate yearly loadings and give some indication of the variability of these contaminants. Monthly monitoring will also be used to speciate generic parameters which are measured more frequently such as phenolics.

The majority of EMPPL compounds will be monitored at a frequency of at least monthly (See Table 8, Appendix B). Inorganic parameters detected in undiluted effluents at concentrations below current Provincial Water Quality Objectives will be monitored less frequently. Priority pollutants not-detected and not expected to be present will also be monitored less frequently.

The parameters selected for monthly sampling include ammonia plus ammonium, nitrate plus nitrite, cyanide, mercury, total alkyl lead, sulfides, fluorides, halogenated volatiles, non-halogenated volatiles, water soluble volatiles, base neutral extractables (see weekly), acid extractables, fatty and resin acids and PCBs. Total alkyl lead will be monitored only if lead concentrations exceed one milligram per litre. Entire groups of chemicals will be analyzed since the cost for individual analysis is identical to the cost for group analysis. The rationale for monitoring these parameters on a monthly basis is as follows:

Cyanide	-	detected during pre-regulation monitoring;
	-	free cyanide is toxic to fish at low concentrations. Provincial Water Quality Objective for free cyanide is 5 ug/l. Monthly monitoring is required to interpret biological monitoring data.
Mercury	-	detected during pre-regulation monitoring at concentrations above the method detection limit but below the treatable level of 36 ug/l (17);

	-	may be present as a contaminant in charge metals.
Total Alkyl Lead	-	if total lead exceeds one milligram per litre, alkyl leads may exist at harmful concentrations and should be monitored separately;
	-	alkyl leads were detected during pre-regulation monitoring studies when total lead concentrations exceeded one milligram per litre.
Sulfides	-	present in slag quench wastewater;
	-	detected during pre-regulation monitoring.
Halogenated Volatiles	-	used as degreasing and cleaning solutions and in mold release agents;
	-	nine compounds detected at concentrations above the method detection limits during pre-regulation monitoring. No compounds detected above the LTATEC (See Table 6, Appendix B);
	-	controlled by oil and grease removal since these compounds have a higher affinity for the oil and grease phase than the aqueous phase (17) or by best management practices.
Non-Halogenated Volatiles	-	used as solvents and cleaners and may be formed by decomposition of polymers used in the industry;
	-	seven compounds detected at concentrations above the method detection limits during pre-regulation monitoring. No compounds detected in average concentrations above the LTATEC;
	-	controlled by oil and grease removal since these compounds have a higher affinity for the oil and grease phase than the aqueous phase (17) or by best management practices.
Water Soluble Volatiles	-	may be generated by the thermal decomposition of some organic binders

		(17);
	-	acrylonitrile detected at concentrations above the method detection limit but below treatable levels (17) during pre-regulation monitoring.
Acid Extractables	-	some phenolic compounds are present in high concentrations (greater than 100X the current Provincial Water Quality Objective for total phenolics), however, monthly monitoring is only required since total phenolics are measured more frequently;
	-	two compounds detected above the LTATEC. These were low molecular weight non-chlorinated phenolics which are accounted for by the total phenolics (4AAP) test. Control of total phenolics will ensure control of these species.
Fatty and Resin Acids	-	present in some cutting and machining oils;
	-	oleic acid detected during MOE pre-regulation monitoring.
PCBs	-	historically used in hydraulic oils and electrical transformers;
	-	detected during pre-regulation monitoring at concentrations above the method detection limit but approximating the treatable limit.

v) Characterization and Open Characterization

Characterization and open characterization of the metal casting sector process effluent is required to determine the presence of toxic contaminants listed on EMPPL but not detected to date in metal casting effluent and to identify toxic contaminants not listed on EMPPL.

For practical reasons, the metal casting sector effluent streams were divided into two groups with respect to characterization and open characterization requirements. These include,

- process effluent streams, and

- cooling water effluent streams that contain small quantities of process effluent.

Direct dischargers with process effluent streams include Ford Motor Company, General Motors and Haley Industries. These plants are required to perform characterizations and open characterizations once in each quarter on all process effluent streams and on combined effluent streams that contain un-monitored process effluent. Characterization for this group includes monitoring for the entire EMPPL with the exception of analytical test groups (ATGs) 21 and 22 (herbicides and pesticides) which are delisted. Herbicides and pesticides are normally present in receiving waters resulting from non-industrial sources and are not generated or used in the metal casting sector. ATG 24 (chlorinated dibenzo-p-dioxins and dibenzofurans) is required to be monitored during the first and third quarter only. Open characterization includes an open organic scan and elemental scan.

Process effluent streams are required to be monitored at least monthly for all ATGs except ATG 10 (hydrides), ATG 23 (neutral chlorinated extractables) and ATG 24. Characterization and open characterization will require an additional quarterly analysis for ATG 10 and ATG 23, an additional semi-annual analysis for ATG 24 and an open organic and elemental scan. Analyses for all EMPPL compounds will be at the method detection limits prescribed in the General Regulation.

Direct dischargers with cooling water effluent streams that contain small quantities of process effluent include Canron Inc., Fahramet Steel Castings and Franklin Electric. These plants are required to characterize their cooling water effluent using the entire EMPPL except ATGs 21 to 24. Compounds in these ATGs were not detected in process effluent during pre-regulation monitoring studies and therefore, it is unlikely that these compounds would be detected in diluted process effluent, if present at all.

Chlorinated dibenzo-p-dioxins and dibenzofurans are required to be monitored in the first and third quarterly characterization for the process effluent group. Chlorinated dibenzo-p-dioxins and dibenzofurans were not detected in any known research studies or pre-regulation monitoring studies. The extreme environmental importance of this group warrants that its absence be confirmed at least twice during the monitoring regulation. Pre-regulation monitoring for chlorinated dibenzo-p-dioxins and dibenzofurans was performed on effluent from all major process wastewater generators in the sector and on one separate cooling water effluent.(see Table 3, Appendix B) No chlorinated dibenzo-p-dioxins or dibenzofurans were detected.

Characterization and open characterization is required after

each significant process change which may affect the chemical nature of the final effluent.

B Cooling Water

Cooling water by definition does not come in direct contact with process materials and thus, should not be contaminated by any materials other than those added for water conditioning. Cracked or worn out heat exchanger surfaces, spills to the cooling water collection system, surface erosion of dies and pipes and generally poor housekeeping practices may result in contaminants entering the cooling water. These conditions are considered upset conditions and should be rectified when identified. The sampling program reflects one that is aimed at identification of these upset conditions. A frequency of once per month was selected.

Other than via spills to the collection system, process materials have little potential for contaminating cooling water. Cooling water is used to cool machinery such as furnaces, air compressors and casting machines. It is not used to cool process streams. The parameters chosen for monitoring are parameters that will bring attention to equipment problems and identify sources of contamination that may have been overlooked. Spills of process chemicals to the cooling water system are required to be reported under the Environmental Protection Act.

Chemicals that are added to treat cooling water should not fluctuate significantly since they are added at a controlled rate. Industries are required to record and report the amount of chemicals added. These chemicals, if listed on EMPPL, will also be monitored monthly.

Direct dischargers are required to monitor cooling water monthly for total metals, total suspended solids, oil and grease, hydrogen ion (pH), dissolved organic carbon and phenolics, if phenolic compounds are used on-site. PCBs are required to be monitored quarterly if stored or used on-site. The rationale for these parameters is as follows:

Total Metals	-	may be present from die erosion, chemical additives or process metal losses.
Total Suspended Solids	-	may be present from foundry sands, mold release agents and precipitated metals.
Oil and Grease	-	may be present from hydraulic and lubricating oil leaks or spills.
Hydrogen Ion (pH)	-	indicator of upset conditions.

Dissolved Organic Carbon	-	indicator of organics that may be present from binders, release agents and solvents.
Phenolics	-	if phenolic resins are used, phenols may be present from spills of raw materials or spent foundry sands to the collection system.
PCBs	-	poor housekeeping and improper disposal practices may result in PCB contaminated oils entering the cooling water system.
	-	if PCBs are not used or stored on-site, it is unlikely that contamination will occur.

This PCB monitoring criteria applies only to the six plants that discharge only cooling water or storm water. Plants with any process effluent are required to monitor PCBs either monthly or quarterly under characterization. Of the six plants with only cooling water, four have confirmed PCBs on-site and therefore, are required to monitor quarterly. The two remaining companies have proposed to eliminate their effluent streams by incorporating process changes. It is also important to note, that, the Ministry of the Environment will audit each effluent stream twice during the life of the regulation. Audits will include analyses for PCBs.

Cooling water effluent streams that contain small quantities of process effluent are also required to perform characterization once in each quarter. Reference should be made to Section IX A v, Characterization and Open Characterization, for these requirements.

C Storm water

If raw materials, products or wastes are stored outside, storm water run-off may become contaminated. To identify sources of contamination and the severity of any such contamination, a monitoring program is required.

Storm water should be monitored during a storm event or thaw at least once a month. The minimum number of samples required to generate a statistically sound data base is twelve. In months when no suitable storm event or thaw occurs, a second sample should be taken the following month.

Industries are required to monitor storm water for total metals, total suspended solids, oil and grease, hydrogen ion (pH) and dissolved organic carbon. Fluorides and phenolics are required monthly when materials containing these compounds are stored on-site. PCBs are required to be monitored quarterly if stored or used

on-site. The rationale for these parameters is as follows:

Total Metals	-	may be present from scrap metal and cast products.
Total Suspended Solids	-	may be elevated above natural levels by foundry sands.
Oil and Grease	-	may be present from scrap metals coated in oil or spilt oils.
Hydrogen Ion (pH)	-	indicator of contaminants that alter the hydrogen ion concentration.
Dissolved Organic Carbon	-	indicator of organics that may be present from binders, release agents and solvents.
Fluorides	-	if slag or scrubber sludge is stored on-site, storm water may be contaminated by fluorides which are known to be present in these materials.
Phenolics	-	if phenolic resins are used, phenols may be present from raw material spills or spent foundry sand storage pile run-off.
PCBs	-	poor housekeeping and improper disposal practices may result in PCB contaminated oils entering the storm water collection system.
	-	if PCBs are not used or stored on-site, it is unlikely that contamination will occur. (See discussion on cooling water.)

Most metal casting plants have combined cooling water/ storm water sewer networks such that no single sample could be taken representative of only cooling water or storm water. When this situation exists, a single combined sample should be taken at least once per month and analyzed for the combined list of parameters. If no storm event or thaw occurs in any given month, the effluent stream is required to be monitored in that month as a cooling water effluent stream. In order to comply with the storm water requirements, two samples are required the following month during separate storm events. One sample must be monitored for the combined list of parameters, while the second sample need only be monitored for the storm water parameters.

Companies that are required to monitor a combined process stream for components listed under the process effluent stream schedule, are not required to analyze cooling water and storm

water streams separately since the combined stream is analyzed for all parameters on the cooling water and storm water effluent schedules at a greater frequency.

Some foundries operate on-site disposal facilities for foundry sand. Storm water is not collected from these facilities and therefore, these disposal sites are non-point sources of pollution. This regulation only covers point sources of pollution.

X TOXICITY TESTING

Biomonitoring using both the rainbow trout acute lethality test and the Daphnia magna acute lethality test is included in the metal casting sector monitoring program. These tests are required to determine the impact of the effluent on the biological life in the receiving stream and the degree of toxicity of the effluent.

The metal casting sector effluent streams were divided into two groups with respect to biomonitoring requirements. These include,

- process effluent streams or combined effluent streams, and
- cooling water effluent streams that contain small quantities of process effluent.

Process effluent streams or combined effluent streams are required to be biomonitored monthly using the LC50 rainbow trout acute lethality test and Daphnia magna acute lethality test. Process effluent streams discharging directly to the natural environment are required to be biomonitored prior to final discharge. Process effluent streams discharging to combined effluent streams are required to be biomonitored at a point on the combined stream prior to final discharge.

If three successive full dilution LC50 rainbow trout tests prove non-toxic, subsequent rainbow trout tests may use the single concentration test on full strength effluent only. If any subsequent full strength test shows the stream to be toxic, full dilution LC50 tests shall be required until the criterium has again been met. An effluent is defined as non-toxic if that effluent kills 20 percent or less of the rainbow trout at any dilution.

Cooling water effluent streams that contain small quantities of process effluent are required to be biomonitored quarterly using the LC50 rainbow trout acute lethality test and Daphnia magna acute lethality test.

Plants with any quantity of process effluent discharged to cooling water effluent streams are required to biomonitor their cooling water effluent streams as part of their combined effluent.

Plants that discharge only cooling water or storm water are not required to conduct toxicity tests. There are six such plants in the sector. These plants **do not** discharge any process effluent. Toxicity testing for cooling water effluent streams at these metal casting plants is not required for the following reasons:

- Cooling water for these six small plants is not used to cool process streams but is used to cool one or more of the following: die casting machines, centrifugal molds, furnace parts, shell core molding machine parts, air compressors and hydraulic oil.

  In the case of dies, molds, furnace parts and machine parts, as well as air compressors, the cooling water is used to remove heat from metallic components to protect these components against deformation by heat. The potential for continuous contamination of the cooling water is extremely limited.

  Any leaks of process materials to the cooling water will be detected by the monthly chemical monitoring program for cooling water effluent streams which includes analysis for oil and grease, total metals, total suspended solids, phenolics (4AAP), pH and dissolved organic carbon.

- Cooling water is taken from municipal water supplies and the use of toxic algicides and slimicides is not necessary.

XI MONITORING STRATEGY - SITE-SPECIFIC APPLICATION

The monitoring principles described previously have been applied to the sector to produce the site-specific monitoring schedules listed in the Metal Casting Sector Effluent Monitoring Regulation. The rationale for any deviations from these principles is described below.

A schematic diagram showing all sampling points for each plant is contained in Appendix C.

A. Acustar Canada Inc.

Acustar is required to monitor the storm sewer effluent using the requirements for cooling water and storm water. There are no process effluents discharged to this stream. In addition to these requirements, Acustar is required to monitor PCBs on a monthly basis since PCBs were detected during pre-regulation monitoring.

B. The **Bowmanville Foundry Co. Limited**

The Bowmanville Foundry is required to monitor the furnace cooling system effluent using the requirements for both cooling water and storm water. This stream contains only cooling water from the induction furnaces and site run-off. PCBs are required to be monitored quarterly since they are stored on-site.

C. Canron Inc., Pipe Division

Canron is required to monitor four cooling water and/or storm water effluent streams and one cooling water effluent stream that contains small amounts of process effluent. Canron discharges these streams to a municipal storm collection system at various locations. The collection system is shared by other industries which necessitates that each stream be monitored separately.

The five discharge points identified are as follows:

- South Storm Sewer
- Cement Lining Sump Pit Effluent
- Main Floor Drain Sump Pit Effluent
- Accubar Effluent
- Cupola Scrubber Sump Pit Effluent.

Other discharge points exist, however, these contain only storm water effluent from roof drains and non-process areas.

The south storm sewer, cement lining sump pit effluent and main floor drain sump pit effluent are required to be monitored using the requirements for cooling water and/or storm water effluent as shown in the schedules. These streams contain only cooling and/or storm water. PCBs are required to be monitored quarterly since they are stored on-site.

The accubar effluent is required to be monitored using the

requirements for cooling water with the exception of phenolics and PCBs. The accubar effluent originates from a closed once-through cooling system for a continuous casting die. Contamination from phenolic resins and PCBs is virtually impossible.

The cupola scrubber sump pit effluent is required to be monitored using the requirements for cooling water with the addition of monthly monitoring for fluorides, quarterly characterizations and quarterly biomonitoring. Characterization is restricted to those analytical test groups containing compounds identified in pre-regulation monitoring for this sector. This includes all ATGs except ATGs 21, 22, 23 and 24. This stream contains cooling water from the cupola and induction furnaces and intermittent overflows from the cupola gas scrubber system and slag quench tank. The cupola gas scrubber system is intended to be a 100% recirculating system, however, the system overflows when make up water exceeds the evaporation rate. This occurs when the cupola temperature falls. The slag quench tank also overflows when the make up water exceeds the evaporation rate. These process wastewater sources are minor in comparison to the overall plant discharge. Since this stream is not representative of typical foundry process effluent and therefore, could not be used to generate "limit setting" data, strict process effluent stream monitoring requirements are not warranted.

D. Fahramet Steel Castings, Indusmin Division of Falconbridge Limited

Fahramet is required to monitor cooling pond overflow using the requirements for cooling water and storm water. Fahramet is also required to carry out quarterly characterizations and quarterly biomonitoring. Characterization in restricted to those analytical test groups containing compounds identified in pre-regulation monitoring for this sector. This includes all ATGs except ATGs 21, 22, 23 and 24.

Fahramet discharges cooling water from a sand cooling system, electric arc and induction furnaces and air compressors to the cooling pond for recirculation. Fahramet also discharges a mold wash tank overflow and quench tank to the cooling pond. These discharges are minor in comparison to the cooling water component. The mold wash consists of an aqueous suspension of silicon dioxide, an inert solid. Quench tank wastes generally contain elevated levels of metals and solids and may contain some organics (17). For this reason, monitoring for organics that were detected in the sector pre-regulation monitoring program is required. PCBs are included in the quarterly characterization since they are stored on-site.

E. Ford Motor Company of Canada Limited

Ford is required to monitor the foundry process effluent immediately after treatment and the combined stream effluent

using the requirements for process effluent. The combined stream receives process effluent from the engine plant which by-passes the foundry wastewater treatment plant. This effluent is discharged to the combined stream along with cooling water and storm water. A single sampling point on the combined stream will provide for monitoring of the engine plant effluent and other miscellaneous streams.

F. Franklin Electric of Canada Ltd.

Franklin is required to monitor cooling pond overflow using the requirements for cooling water and storm water. Franklin is also required to carry out quarterly characterizations and quarterly biomonitoring. Characterization in restricted to those analytical test groups containing compounds identified in pre-regulation monitoring for this sector. This includes all ATGs except ATGs 21, 22, 23 and 24.

Franklin discharges cooling water from air compressors, die casting machines and hydraulic fluid cooling systems to the cooling pond. Franklin also discharges a quench tank overflow and phosphate rinse tank overflow to the cooling pond. These discharges are minor in comparison to the cooling water component. Quench tank wastes generally contain elevated levels of metals and solids and may contain some organics (17). Phosphate rinses may contain residual phosphates and oils and greases removed from the surface of the castings. For this reason, monitoring for organics that were detected in the sector pre-regulation monitoring program is required. PCBs are included in the quarterly characterization since they are stored on-site.

G. General Motors of Canada Limited

General Motors is required to monitor the foundry process effluent using the requirements for process effluent. The combined effluent stream is to be monitored using an approach that is a combination of the process effluent requirements and storm and cooling water requirements. This approach is considered appropriate since all streams entering the main process effluent stream contain of only cooling water and/or site run-off. Site run-off, however, is known to contain contaminants associated with process materials. Plant roads and process areas are washed frequently to control dust and remove wastes. The degree of contamination of these streams is not expected to be as significant as with process effluent. Pre-regulation monitoring data confirms this.

Monthly monitoring of process effluent for ammonia plus ammonium and fluorides is specified since these parameters were not detected at elevated levels during pre-regulation monitoring.

The combined effluent stream monitoring requirements are a

down graded version of the process effluent requirements. Parameters requiring daily monitoring under the process schedule will be monitored for thrice weekly. Thrice weekly process compounds will be monitored for weekly except for oil and grease which will remain thrice weekly. Oil and grease is considered the parameter most likely to contaminate the combined effluent stream. Characterization for the combined stream consists of those analytical test groups containing compounds which are known to be present in foundry effluent. PCBs will be monitored for monthly since they were detected in pre-regulation monitoring. Ammonia plus ammonium and total cyanide will be monitored monthly to coincide with biomonitoring. Two open characterizations will be undertaken to identify non-EMPPL compounds.

H. Haley Industries Limited

Haley is required to monitor both the NE and SE process sewers using the requirements for process effluent. The NE sewer is to be monitored for nitrates plus nitrites weekly since this sewer receives nitric acid bath wastes. Ammonia plus ammonium is to be monitored for thrice weekly in both sewers since high levels were detected in pre-regulation studies. Fluorides are to be monitored thrice weekly in both sewers since high levels were detected during pre-regulation monitoring studies in the SE sewer and effluent from the hydrofluoric acid treatment tanks is discharged to the NE sewer.

Water soluble volatiles are to be monitored only during characterization. These compounds were not detected during pre-regulation monitoring and are not likely to be formed. Acrolein and acrylonitrile are formed by the decomposition of glycerine and acrylic resins respectively. These compounds are not used at this site.

Weekly monitoring for phenanthrene and naphthalene is not required at this site, since, these compounds were detected at low concentrations (less than 3 ug/l). The mass loadings of base neutral extractables from this site are several orders of magnitude less than the mass loadings from the other two plants required to monitor.

I. Magalloy Ltd.

Magalloy is required to monitor the cooling tank effluent using the requirements for cooling water. This stream contains only cooling water from the induction furnaces and thermal sand reclamation system.

J. Richmond Die Casting Ltd.

Richmond Die Casting is required to monitor the 12 inch outlet sewer using the requirements for cooling water and storm

water. This stream receives only cooling water from the die casting machines and air compressors and site run-off. PCBs are required to be monitored quarterly since they are present on-site.

K. A. H. **Tallman Bronze Company Ltd.**

Tallman Bronze is required to monitor the compressor cooling water effluent and casting machine cooling water effluent using the requirements for cooling water. These effluents receive only cooling water from one air compressor and two centrifugal casting machines, respectively. Monitoring for fluorides is not required since fluorides are not used on-site. Monitoring for phenolics on the compressor cooling water effluent is not required since this effluent is not exposed to the plant environment.

L. Western Foundry Company Limited

Western Foundry is required to monitor both the furnace cooling water sewer and core machine/compressor cooling water sewer using the requirements for cooling water and storm water. These sewers receive only site run-off and cooling water from the induction furnaces, air compressors and one shell core machine. PCBs are required to be monitored quarterly since they are stored on-site.

XII MONITORING COSTS

The monitoring requirements under the MISA program will require both operating and capital expenditures. The Policy and Planning Branch of the Ministry has produced two reports which assess the economic environment of the metal casting sector and analyze the financial implications of the incremental costs of monitoring imposed by the MISA monitoring requirements.

The first report entitled "Metal Casting Industry Economic Profile" (9) contains an economic assessment and analysis of the metal casting sector based on publicly available data, information on domestic casting operations, company data on plants that are classified as direct dischargers and market trends.

The report concludes that,

- profitability among casting manufacturers varies widely,
- competition among casting plants is strong,
- the industry appears to have stabilized after years of decline, and
- the outlook for the industry appears to be stable.

The second report entitled "Economic Implications of the MISA Monitoring Regulations on Ontario's Metal Casting Sector" (10) presents estimates and implications of the incremental costs to the metal casting sector of the effluent monitoring regulation requirements. These estimates were developed with the participation of industry.

Incremental capital costs for all metal casting plants which are direct dischargers subject to the MISA monitoring requirements are estimated to be $500.9 thousand.

Operating costs for all metal casting plants over the twelve month period of the regulation are estimated to be $ 944.1 thousand.

Total estimated incremental costs of the MISA monitoring requirements including both capital and operating expenses for the metal casting sector are estimated to be $1445.0 thousand. Within the sector, the incremental costs including both capital and operating expenses range from a high of $496.1 thousand for Ford to a low of $7.8 thousand for Magalloy.

Estimates of the incremental costs by plant are presented in Table 9, Appendix B.

The metal casting sector monitoring requirements are pipe specific and based on a monitoring rationale developed solely for the metal casting sector. This approach was selected in order to eliminate unnecessary monitoring. If however, this pipe specific and sector specific approach was not used, total analytical and toxicity costs would be significantly higher. The Policy and Planning Branch of this Ministry estimated an alternate analytical and toxicity cost based on an "equitable" scenario (10). The following assumptions were used to develop this scenario:

- All effluent streams would be required to be monitored for a consistent set of parameters at the same frequency.

- Cooling water effluent streams containing small quantities of process effluent would be subjected to process effluent stream monitoring requirements.

- Cooling water effluent streams would be subjected to quarterly characterization and toxicity testing.

The "equitable" scenario resulted in analytical and toxicity costs ranging from $14,840 to $219,344 per plant. The total estimated analytical and toxicity cost of this scenario is $1,155,848. The estimated cost of this scenario represents a 66.7% increase over the total cost of the proposed regulation for these activities. The total cost for these activities for the proposed regulation is $693,266.

The "equitable" scenario is estimated to cost approximately $460,000 more than the proposed regulation. Much of the additional cost burden would be borne by the mid-size and smaller plants. Canron's estimated cost for these activities would increase $123,000 from $37,000 to $160,000. The costs to Fahramet and Franklin would increase over $94,000 each. This analysis supports the cost-effectiveness of the pipe specific approach.

The financial impacts of the estimated monitoring costs are presented in Table 10, Appendix B. The impact assessment could not be applied to all companies in the sector since many of the companies are privately owned and refused to divulge financial records. These plants are aware of the cost of monitoring.

The financial impact of the estimated monitoring costs on those companies for which financial records are available varies greatly. The monitoring capital cost as a percent of the annual average capital expenditure for the period 1982 to 1987 ranges from a high of 2.385% for Haley to a low of 0.001% for Acustar (owned by Chrysler U.S.). The monitoring operating cost as a percent of annual after-tax earnings for the period 1982 to 1987 ranges from a high of 14.189% for Canron to a low of 0.001% for Acustar. One company, Fahramet (owned by Falconbridge), reported an average loss over these years.

Potential benefits to the metal casting sector plants required to monitor include reductions to operating costs by reducing water usage and process material losses, and goodwill gained by demonstrating to the public that the company is responding to environmental problems.

The monitoring regulation may have a small, but positive impact on employment in the metal casting sector because extra staff may be required to take samples, maintain equipment and report data. The monitoring requirements will stimulate demand for laboratory services and flow measurement and sampling equipment. The monitoring data base will be available to design cost-effective control programs aimed at the virtual elimination of toxic contaminants.

XIII REFERENCES

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APPENDIX A

SOURCESOFMONITORINGDATAREVIEWEDTOFORMULATE THE METAL CASTING SECTOR MONITORING REGULATION

1. Canviro Consultants, Pre-regulation monitoring studies at Ford Motor Company Limited, General Motors of Canada Limited, Acustar Canada Inc. and Haley Industries Limited, 1988.

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7. Ministry of the Environment, Sampling results from Abatement studies at select sites including Canron Inc, Pipe Division and Western Foundry Company Limited, 1985 to 1987.

8. Regional Municipality of Waterloo, Storm sewer analysis from 1981 to 1988 for select industries including Alloy Casting Industries Limited, Bibby Ste. Croix Foundries Inc. and Crowe Foundry Limited.

APPENDIX B

TABLES

TABLE 1: **LONG-TERM AVERAGE TREATMENT EFFECTIVENESS CONCENTRATIONS FOR ORGANIC PRIORITY POLLUTANTS (U.S. EPA)(17)**

Parameter	LTATEC (ug/l)
acenaphthene	10
benzene	20
benzidine	22
carbon tetrachloride	20
chlorobenzene	20
1,2-dichloroethane	22
1,1,1-trichloroethane	20
1,1,2-trichloroethane	22
2,4,6-trichlorophenol	48
p-chloro-m-cresol	22
chloroform	78
2-chlorophenol	22
1,2-trans-dichloroethylene	22
2,4-dichlorophenol	48
2,4-dimethylphenol	10
ethylbenzene	20
fluoranthene	18
bis(2-chloroethoxy)methane	24
methylene chloride	59
methyl chloride	24
dichlorobromomethane	16
isophorone	16
naphthalene	24
2-nitrophenol	22
4-nitrophenol	22
2,4-dinitrophenol	10
4,6-dinitro-o-cresol	10
N-nitrosodiphenylamine	10
N-nitrosodi-n-propylamine	10
pentachlorophenol	14
phenol	18
bis(2-ethylhexyl) phthalate	32
butyl benzyl phthalate	10
di-n-butyl phthalate	22
di-n-octyl phthalate	22
diethyl phthalate	16
dimethyl phthalate	13
benzo(a)anthracene	10
benzo(a)pyrene	10

Parameter	LTATEC (ug/l)
3,4-benzofluoranthene	11
benzo(k)fluoranthene	14
chrysene	14
acenaphthalene	14
anthracene/phenanthrene	10
fluorene	10
pyrene	12
tetrachloroethylene	47
toluene	20
trichloroethylene	20

TABLE 2: **PROBABILITY OF DETECTING AT LEAST ONE SAMPLE ABOVE THE DETECTION LIMIT**

Single Sample Probability Of Detect/Non-Detect		Total Number of Samples					
p	q	12	10	8	6	4	2
0.5	0.5	.999	.999	.996	.984	.937	.750
0.4	0.6	.998	.994	.983	.953	.870	.640
0.3	0.7	.986	.972	.942	.882	.759	.510
0.2	0.8	.931	.893	.832	.738	.590	.360
0.1	0.9	.717	.651	.569	.468	.344	.190
0.01	0.99	.113	.095	.077	.058	.039	.019

TABLE 3: SUMMARY OF CHARACTERIZATIONS AND DIOXIN ANALYSES FOR THE METAL CASTING SECTOR PRE-REGULATION MONITORING PROGRAM

SITE	STREAM	NUMBER OF SAMPLES					
		EMPPL ORGANICS		OPEN ORGANIC SCANS		DIOXINS & FURANS	
		INDUSTRY	MOE	INDUSTRY	MOE	INDUSTRY	MOE
Acustar	Raw Water	1 *	-	-	-	-	-
	Cooling Water	3	-	1	-	1	-
General Motors	Intake	3	-	3	-	1	-
	Raw Process	3	1	3	1	1	1
	Combined	3	-	3	-	1	-
Ford	Intake	3	-	3	-	1	-
	Treated Process	3	1	3	1	1	1
	Combined	3	-	3	-	1	-
Haley	Intake	1	-	1	-	1	-
	S.E. Process	3	-	3	-	1	-
	N.E. Process	3	1	3	1	1	1

* Volatiles only

TABLE 4: FREQUENCY OF DETECTION OF COMPOUNDS ABOVE THE MDL IN ATGs 16-20, 23, 24, 26 AND 27 DURING PRE-REGULATION MONITORING STUDIES

ANALYTICAL TEST GROUP #	NAME	PARAMETERS	GENERAL MOTORS Intake	GENERAL MOTORS Raw Process	GENERAL MOTORS Combined	FORD Intake	FORD Treated Process	FORD Combined	HALEY Intake	HALEY S.E. Process	HALEY N.E. Process	ACUSTAR Raw Water	ACUSTAR Cooling Water
16	Volatiles, Halogenated	1,1,2,2-Tetrachloroethane	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	0 / 1	0 / 3
		1,1,2-Trichloroethane	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	2 / 3	1 / 4	0 / 1	0 / 3
		1,1-Dichloroethane	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	3 / 3	1 / 4	0 / 1	0 / 3
		1,1-Dichloroethylene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	3 / 3	0 / 4	0 / 1	0 / 3
		1,2-Dichlorobenzene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	1 / 4	0 / 1	0 / 3
		1,2-Dichloroethane (Ethylene dichloride)	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	2 / 3	0 / 4	0 / 1	0 / 3
		1,2-Dichloropropane	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	0 / 1	0 / 3
		1,3-Dichlorobenzene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	0 / 1	0 / 3
		1,4-Dichlorobenzene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	0 / 1	0 / 3
		Bromoform	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	0 / 1	0 / 3
		Bromomethane	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	0 / 1	0 / 3
		Carbon tetrachloride	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	0 / 1	0 / 3
		Chlorobenzene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	1 / 4	0 / 1	0 / 3
		Chloroform	0 / 3	1 / 4	2 / 3	0 / 3	0 / 4	1 / 3	0 / 1	0 / 3	0 / 4	1 / 1	3 / 3
		Chloromethane	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	0 / 1	0 / 3
		Cis-1,3-Dichloropropylene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	0 / 1	0 / 3
		Dibromochloromethane	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	1 / 1	2 / 3
		Ethylene dibromide	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	0 / 1	0 / 3
		Methylene chloride	3 / 3	3 / 4	3 / 3	3 / 3	4 / 4	3 / 3	1 / 1	3 / 3	3 / 4	0 / 1	2 / 3
		Tetrachloroethylene (Perchloroethylene)	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	0 / 1	0 / 3
		Trans-1,2-Dichloroethylene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	0 / 1	0 / 3
		Trans-1,3-Dichloropropylene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	0 / 1	0 / 3
		Trichloroethylene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	2 / 3	0 / 4	0 / 1	0 / 3
		Trichlorofluoromethane	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	0 / 1	0 / 3
		Vinyl chloride (Chloroethylene)	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	0 / 1	0 / 3
17	Volatiles, Non-Halogenated	Benzene	0 / 3	2 / 4	0 / 3	0 / 3	4 / 4	1 / 3	0 / 1	1 / 3	1 / 4	0 / 1	0 / 3
		Styrene	0 / 3	1 / 4	0 / 3	0 / 3	3 / 4	0 / 3	0 / 1	0 / 3	0 / 4	0 / 1	0 / 3
		Toluene	3 / 3	4 / 4	2 / 3	3 / 3	4 / 4	2 / 3	0 / 1	2 / 3	3 / 4	1 / 1	3 / 3
		o-Xylene	0 / 3	4 / 4	0 / 3	0 / 3	1 / 4	0 / 3	0 / 1	2 / 3	2 / 4	0 / 1	0 / 3
		m-Xylene and p-Xylene	0 / 3	4 / 4	0 / 3	0 / 3	2 / 4	1 / 3	0 / 1	3 / 3	3 / 4	0 / 1	0 / 3
18	Volatiles, Water Soluble	Acrolein	0 / 3	0 / 3	0 / 3	0 / 3	0 / 3	0 / 3	0 / 1	0 / 3	0 / 3	0 / 1	0 / 3
		Acrylonitrile	0 / 3	2 / 3	0 / 3	0 / 3	2 / 3	0 / 3	0 / 1	0 / 3	0 / 3	0 / 1	0 / 3

TABLE 4: FREQUENCY OF DETECTION OF COMPOUNDS ABOVE THE MDL IN ATGs 16-20, 23, 24, 26 AND 27 DURING PRE-REGULATION MONITORING STUDIES

ANALYTICAL TEST GROUP #	NAME	PARAMETERS	GENERAL MOTORS Intake	GENERAL MOTORS Raw Process	GENERAL MOTORS Combined	FORD Intake	FORD Treated Process	FORD Combined	HALEY Intake	HALEY S.E. Process	HALEY N.E. Process	ACUSTAR Raw Water	ACUSTAR Cooling Water
19	Extractables, Base Neutral	Acenaphthene	0 / 3	3 / 4	2 / 3	0 / 3	1 / 4	0 / 3	0 / 1	1 / 3	0 / 4	NA	0 / 3
		5-nitro Acenaphthene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Acenaphthylene	0 / 3	3 / 4	3 / 3	0 / 3	1 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Anthracene	0 / 3	3 / 4	0 / 3	0 / 3	1 / 4	1 / 3	0 / 1	2 / 3	2 / 4	NA	0 / 3
		Benz(a)anthracene	0 / 3	2 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	1 / 4	NA	0 / 3
		Benzo(a)pyrene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Benzo(b)fluoranthene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	1 / 4	NA	0 / 3
		Benzo(g,h,i)perylene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Benzo(k)fluoranthene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	1 / 4	NA	0 / 3
		Biphenyl	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
		Camphene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		1-Chloronaphthalene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		2-Chloronaphthalene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Chrysene	0 / 3	3 / 4	0 / 3	0 / 3	1 / 4	0 / 3	0 / 1	0 / 3	1 / 4	NA	0 / 3
		Dibenz(a,h)anthracene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Fluoranthene	0 / 3	3 / 4	1 / 3	0 / 3	2 / 4	0 / 3	0 / 1	2 / 3	2 / 4	NA	0 / 3
		Fluorene	1 / 3	3 / 4	3 / 3	0 / 3	2 / 4	1 / 3	0 / 1	2 / 3	0 / 4	NA	0 / 3
		Indeno(1,2,3-cd)pyrene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	1 / 4	NA	0 / 3
		Indole	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		1-Methylnaphthalene	0 / 3	3 / 4	1 / 3	0 / 3	1 / 4	1 / 3	0 / 1	1 / 3	0 / 4	NA	0 / 3
		2-Methylnaphthalene	0 / 3	1 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Naphthalene	1 / 3	4 / 4	1 / 3	0 / 3	1 / 4	1 / 3	0 / 1	2 / 3	0 / 4	NA	0 / 3
		Perylene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Phenanthrene	0 / 3	3 / 4	2 / 3	0 / 3	2 / 4	2 / 3	0 / 1	3 / 3	2 / 4	NA	0 / 3
		Pyrene	0 / 3	3 / 4	0 / 3	0 / 3	2 / 4	0 / 3	0 / 1	1 / 3	2 / 4	NA	0 / 3
		Benzyl butyl phthalate	0 / 3	1 / 4	0 / 3	0 / 3	1 / 4	1 / 3	0 / 1	0 / 3	1 / 4	NA	0 / 3
		Bis(2-ethylhexyl) phthalate	3 / 3	3 / 4	3 / 3	3 / 3	3 / 4	3 / 3	1 / 1	3 / 3	4 / 4	NA	3 / 3
		Di-n-butyl phthalate	2 / 3	2 / 4	1 / 3	1 / 3	1 / 4	1 / 3	1 / 1	1 / 3	1 / 4	NA	1 / 3
		4-Bromophenyl phenyl ether	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		4-Chlorophenyl phenyl ether	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Bis(2-chloroisopropyl)ether	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Bis(2-chloroethyl)ether	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Diphenyl ether	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		2,4-Dinitrotoluene	0 / 3	1 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		2,6-Dinitrotoluene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3

TABLE 4: FREQUENCY OF DETECTION OF COMPOUNDS ABOVE THE MDL IN ATGs 16-20, 23, 24, 26 AND 27 DURING PRE-REGULATION MONITORING STUDIES

ANALYTICAL TEST GROUP #	NAME	PARAMETERS	GENERAL MOTORS Intake	GENERAL MOTORS Raw Process	GENERAL MOTORS Combined	FORD Intake	FORD Treated Process	FORD Combined	HALEY Intake	HALEY S.E. Process	HALEY N.E. Process	ACUSTAR Raw Water	ACUSTAR Cooling Water
19	Extractables, Base Neutral (continued)	Bis(2-chloroethoxy)methane	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Diphenylamine	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		N-Nitrosodiphenylamine	0 / 3	1 / 4	0 / 3	0 / 3	0 / 4	1 / 3	0 / 1	1 / 3	1 / 4	NA	0 / 3
		N-Nitrosodi-n-propylamine	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	1 / 3
20	Extractables, Acid (Phenolics)	2,3,4,5-Tetrachlorophenol	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		2,3,4,6-Tetrachlorophenol	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		2,3,5,6-Tetrachlorophenol	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		2,3,4-Trichlorophenol	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		2,3,5-Trichlorophenol	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		2,4,5-Trichlorophenol	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		2,4,6-Trichlorophenol	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		2,4-Dimethyl phenol	0 / 3	3 / 4	3 / 3	0 / 3	2 / 4	1 / 3	0 / 1	3 / 3	1 / 4	NA	0 / 3
		2,4-Dinitrophenol	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		2,4-Dichlorophenol	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		2,6-Dichlorophenol	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		4,6-Dinitro-o-cresol	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		2-Chlorophenol	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		4-Chloro-3-methylphenol	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		4-Nitrophenol	0 / 3	2 / 4	0 / 3	0 / 3	1 / 4	0 / 3	0 / 1	2 / 3	0 / 4	NA	0 / 3
		m-Cresol	0 / 3	3 / 4	0 / 3	0 / 3	2 / 4	1 / 3	0 / 1	2 / 3	0 / 4	NA	0 / 3
		o-Cresol	0 / 3	3 / 4	1 / 3	0 / 3	1 / 4	1 / 3	0 / 1	2 / 3	0 / 4	NA	0 / 3
		p-Cresol	1 / 3	3 / 4	0 / 3	0 / 3	1 / 4	1 / 3	0 / 1	2 / 3	1 / 4	NA	0 / 3
		Pentachlorophenol	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Phenol	2 / 3	3 / 4	2 / 3	1 / 3	2 / 4	1 / 3	0 / 1	3 / 3	2 / 4	NA	0 / 3
23	Extractables, Neutral -Chlorinated	1,2,3,4-Tetrachlorobenzene	0 / 3	1 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		1,2,3,5-Tetrachlorobenzene	0 / 3	1 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		1,2,4,5-Tetrachlorobenzene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		1,2,3-Trichlorobenzene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		1,2,4-Trichlorobenzene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		2,4,5-Trichlorotoluene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Hexachlorobenzene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Hexachlorobutadiene	0 / 3	0 / 4	0 / 3	0 / 3	1 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Hexachlorocyclopentadiene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Hexachloroethane	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Octachlorostyrene	0 / 3	1 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3
		Pentachlorobenzene	0 / 3	0 / 4	0 / 3	0 / 3	0 / 4	0 / 3	0 / 1	0 / 3	0 / 4	NA	0 / 3

TABLE 4: FREQUENCY OF DETECTION OF COMPOUNDS ABOVE THE MDL IN ATGs 16-20, 23, 24, 26 AND 27 DURING PRE-REGULATION MONITORING STUDIES

ANALYTICAL TEST GROUP #	NAME	PARAMETERS	GENERAL MOTORS			FORD			HALEY			ACUSTAR	
			Intake	Raw Process	Combined	Intake	Treated Process	Combined	Intake	S.E. Process	N.E. Process	Raw Water	Cooling Water
24	Chlorinated Dibenzo-p-dioxins and Dibenzofurans	2,3,7,8-Tetrachlorodibenzo-p-dioxin	0 / 1	0 / 2	0 / 1	0 / 1	0 / 2	0 / 1	0 / 1	0 / 1	0 / 2	NA	0 / 1
		Octachlorodibenzo-p-dioxin	0 / 1	0 / 2	0 / 1	0 / 1	0 / 2	0 / 1	0 / 1	0 / 1	0 / 2	NA	0 / 1
		Octachlorodibenzofuran	0 / 1	0 / 2	0 / 1	0 / 1	0 / 2	0 / 1	0 / 1	0 / 1	0 / 2	NA	0 / 1
		Total heptachlorinated dibenzo-p-dioxins	0 / 1	0 / 2	0 / 1	0 / 1	0 / 2	0 / 1	0 / 1	0 / 1	0 / 2	NA	0 / 1
		Total heptachlorinated dibenzofurans	0 / 1	0 / 2	0 / 1	0 / 1	0 / 2	0 / 1	0 / 1	0 / 1	0 / 2	NA	0 / 1
		Total hexachlorinated dibenzo-p-dioxins	0 / 1	0 / 2	0 / 1	0 / 1	0 / 2	0 / 1	0 / 1	0 / 1	0 / 2	NA	0 / 1
		Total hexachlorinated dibenzofurans	0 / 1	0 / 2	0 / 1	0 / 1	0 / 2	0 / 1	0 / 1	0 / 1	0 / 2	NA	0 / 1
		Total pentachlorinated dibenzo-p-dioxins	0 / 1	0 / 2	0 / 1	0 / 1	0 / 2	0 / 1	0 / 1	0 / 1	0 / 2	NA	0 / 1
		Total pentachlorinated dibenzofurans	0 / 1	0 / 2	0 / 1	0 / 1	0 / 2	0 / 1	0 / 1	0 / 1	0 / 2	NA	0 / 1
		Total tetrachlorinated dibenzo-p-dioxins	0 / 1	0 / 2	0 / 1	0 / 1	0 / 2	0 / 1	0 / 1	0 / 1	0 / 2	NA	0 / 1
		Total tetrachlorinated dibenzofurans	0 / 1	0 / 2	0 / 1	0 / 1	0 / 2	0 / 1	0 / 1	0 / 1	0 / 2	NA	0 / 1
26	Fatty and Resin Acids	Abietic acid	NA	NA	NA	NA	0 / 1	NA	NA	NA	0 / 1	NA	NA
		Chlorodehydroabietic acid	NA	NA	NA	NA	0 / 1	NA	NA	NA	0 / 1	NA	NA
		Dehydroabietic acid	NA	NA	NA	NA	0 / 1	NA	NA	NA	0 / 1	NA	NA
		Isopimaric acid	NA	NA	NA	NA	0 / 1	NA	NA	NA	0 / 1	NA	NA
		Levopimaric acid	NA	NA	NA	NA	0 / 1	NA	NA	NA	0 / 1	NA	NA
		Neoabietic acid	NA	NA	NA	NA	0 / 1	NA	NA	NA	0 / 1	NA	NA
		Oleic acid	NA	NA	NA	NA	1 / 1	NA	NA	NA	1 / 1	NA	NA
		Pimaric acid	NA	NA	NA	NA	0 / 1	NA	NA	NA	0 / 1	NA	NA
27	Polychlorinated Biphenyls (PCBs) (Total)	PCBs (Total)	0 / 3	3 / 4	0 / 3	0 / 3	1 / 4	1 / 3	0 / 1	0 / 3	1 / 4	NA	1 / 3

NA - Not Analyzed

TABLE 5: NUMBER OF COMPOUNDS DETECTED ABOVE MDL FOR ANALYTICAL TEST GROUPS 16-20, 23, 24, 26 AND 27 DURING THE METAL CASTING SECTOR PRE-REGULATION MONITORING PROGRAM

ANALYTICAL TEST GROUP		ACUSTAR	GENERAL MOTORS		FORD		HALEY	
#	NAME	COOLING WATER	PROCESS	COMBINED	PROCESS	COMBINED	NE PROCESS	SE PROCESS
16	Volatiles, Halogenated	3 *	2	2	1	2	5	6
17	Volatiles, Non-Halogenated	1 *	5	1	5	3	4	4
18	Volatiles, Water Soluble	0	1	0	1	0	0	0
19	Extractables, Base Neutral	3 *	17	9	13	9	13	11
20	Extractables, Acid (Phenolics)	0	6	3	6	5	3	6
23	Extractables, Neutral -Chlorinated	0	3(X)(Y)	0	1(X)	0	0	0
24	Chlorinated Dibenzo-p-dioxins and Dibenzofurans	0	0	0	0	0	0	0
26	Fatty & Resin Acids	NA	NA	NA	1	NA	1	NA
27	PCBs (Total)	YES	YES	YES	YES	YES	YES	NO

* - Also detected in raw water at similar concentrations or possible interference
(X) - Detected in one sample only by MOE at low concentrations
(Y) - Chromatograms complicated, lab could not confirm results
NA - Not analyzed

TABLE 6: COMPOUNDS IN ATGs 16-20, 23, 24 AND 26 DETECTED ABOVE US EPA LONG-TERM AVERAGE TREATMENT EFFECTIVENESS CONCENTRATIONS IN PROCESS EFFLUENTS DURING PRE-REGULATION MONITORING STUDIES

ANALYTICAL TEST GROUP #	ANALYTICAL TEST GROUP NAME	PARAMETERS	Company	Average Concentration (μg/L)	Range (μg/L)	Long-Term Average Treatment Effectiveness Concentration (μg/L) (BAT)*
17	Volatiles, Non-Halogenated	Toluene	Haley - NE	9.3	1.5 - 23.2	20
19	Extractables, Base Neutral	Phenanthrene	General Motors	15.3†	6 - 29.2	10
		Bis(2-ethylhexyl) phthalate	Haley - NE	38.8	11 - 91.7	32
		N-Nitrosodiphenylamine	General Motors	6.2†	<0.9 - 17.8	10
20	Extractables, Acid (Phenolics)	2,4-Dimethyl phenol	General Motors	38.7†	27.8 - 46.1	10
			Ford	7.6	<0.5 - 22.3	10
		Phenol	Haley - SE	355.5	47.6 - 868	18
			Ford	45.3	<0.5 - 135.4	18
			General Motors	30.2†	9.6 - 70	18

* - based on oil removal by skimming and chemical addition plus settling

† - detected in process effluent before treatment

TABLE 7: SUMMARY OF MONITORING RESULTS FOR CONVENTIONAL PARAMETERS AT FORD'S WINDSOR CASTING PLANT (FINAL EFFLUENT) BASED ON ENVIRONMENT CANADA'S MONITORING FOR THE UGLCCS DURING DECEMBER 1985 AND NOVEMBER 1987

	1985				1987			
PARAMETER	# OF SAMPLES	MEAN (mg/l)	STANDARD DEVIATION (UNBIASED)	CO-EFFICIENT OF VARIATION	# OF SAMPLES	MEAN (mg/l)	STANDARD DEVIATION (UNBIASED)	CO-EFFICIENT OF VARIATION
Total Phenols	5	648 µg/l	613	0.95*	7	747 µg/l	182	0.24
Oil & Grease	5	3.08	0.48	0.16*	-			
Ammonia	5	0.76	0.35	0.46*	-			
Suspended Solids	5	35.8	5.5	0.15	7	13.3	12.3	0.92*
METALS:								
Aluminum	-	-	-	-	7	1.95	0.28	0.14
Copper	5	0.056	0.009	0.16	7	0.064	0.019	0.3
Chromium	5	0.0124	0.0005	0.04	7	0.0178	0.0037	0.21
Iron	5	4.7	0.19	0.036	7	4.3	1.09	0.25
Lead	5	0.4	0.05	0.12	7	0.52	0.22	0.42
Mercury	5	N.D.	-	-	7	0.088	0.037	0.42
Zinc	5	1.89	0.26	0.14	7	2.23	1.09	0.49*

* - Highest Value
N.D. - Not Detected

TABLE 8: SUMMARY OF MONITORING FREQUENCY FOR STREAMS CONTAINING PROCESS EFFLUENT IN THE METAL CASTING SECTOR MONITORING REGULATION

ANALYTICAL TEST GROUP		GENERAL MOTORS		FORD		HALEY		CANRON PIPE	FAHRAMET	FRANKLIN
#	NAME	Process	Combined	Process	Combined	NE Process	SE Process	Cupola Scrubber Sump Pit Effluent	Cooling Pond Effluent	Cooling Pond Effluent
1	Chemical Oxygen Demand	TW	W	TW	TW	TW	TW	Q	Q	Q
2	Cyanide	M	M	M	M	M	M	Q	Q	Q
3	Hydrogen ion (pH)	D	TW	D	D	D	D	M	M	M
4a	Ammonia and Kjeldahl	M	M	M	M	TW	TW	Q	Q	Q
4b	Nitrate + Nitrite	M	Q	M	M	W	M	Q	Q	Q
5a	Dissolved organic carbon	W	W	W	W	W	W	M	M	M
5b	Total organic carbon	Q	Q	Q	Q	Q	Q	Q	Q	Q
6	Total phosphorus	W	W	W	W	W	W	Q	Q	Q
7	Specific condutance	D	Q	D	D	D	D	Q	Q	Q
8	Suspended solids	D	TW	D	D	D	D	M	M	M
9	Total metals	TW	W	TW	TW	TW	TW	M	M	M
10	Hydrides	Q	Q	Q	Q	Q	Q	Q	Q	Q
11	Chromium (Hexavalent)	TW	W	TW	TW	TW	TW	M	M	M
12	Mercury	M	Q	M	M	M	M	Q	Q	Q
13	Total alkyl lead	M	Q	M	M	M	M	M	M	M
14	Phenolics (4AAP)	D	TW	D	D	D	D	M	M	Q

TABLE 8: SUMMARY OF MONITORING FREQUENCY FOR STREAMS CONTAINING PROCESS EFFLUENT IN THE METAL CASTING SECTOR MONITORING REGULATION

ANALYTICAL TEST GROUP		GENERAL MOTORS		FORD		HALEY		CANRON PIPE	FAHRAMET	FRANKLIN
#	NAME	Process	Combined	Process	Combined	NE Process	SE Process	Cupola Scrubber Sump Pit Effluent	Cooling Pond Effluent	Cooling Pond Effluent
15	Sulphide	M	Q	M	M	M	M	Q	Q	Q
16	Volatiles, Halogenated	M	Q	M	M	M	M	Q	Q	Q
17	Volatiles, Non-Halogenated	M	Q	M	M	M	M	Q	Q	Q
18	Volatiles, Water Soluble	M	Q	M	M	Q	Q	Q	Q	Q
19	Extractables, Base Neutral	W*/M	Q	W*/M	M	M	M	Q	Q	Q
20	Extractables, Acid (Phenolics)	M	Q	M	M	M	M	Q	Q	Q
23	Extractables, Neutral -Chlorinated	Q	-	Q	Q	Q	Q			
24	Chlorinated Dibenzo-p-dioxins and Dibenzofurans	SA	-	SA	SA	SA	SA			
25	Solvent Extractables	TW	TW	TW	TW	TW	TW	M	M	M
26	Fatty and Resin Acids	M	Q	M	M	M	M	Q	Q	Q
27	PCBs (Total)	M	M	M	M	M	M	Q	Q	Q
28a	Open Characterization -Volatiles	Q	SA	Q	Q	Q	Q			
28b	Open Characterization -Extractables	Q	SA	Q	Q	Q	Q			

TABLE 8: SUMMARY OF MONITORING FREQUENCY FOR STREAMS CONTAINING PROCESS EFFLUENT IN THE METAL CASTING SECTOR MONITORING REGULATION

ANALYTICAL TEST GROUP		GENERAL MOTORS		FORD		HALEY		CANRON PIPE	FAHRAMET	FRANKLIN
#	NAME	Process	Combined	Process	Combined	NE Process	SE Process	Cupola Scrubber Sump Pit Effluent	Cooling Pond Effluent	Cooling Pond Effluent
29	Open Characterization -Inorganics	Q	SA	Q	Q	Q	Q			
MC1	Metals	TW	W	TW	TW	TW	TW	M	M	M
MC2	Fluoride	M	Q	TW	TW	TW	TW	M	M	Q

D - Daily
TW - Thrice Weekly
W - Weekly
M - Monthly
Q - Quarterly
SA - Semi-annually
* - Phenanthrene and naphthalene only

TABLE 9: ESTIMATES OF THE INCREMENTAL COSTS BY PLANT FOR THE METAL CASTING SECTOR

Plant	Location	1988 $ in thousands (rounded) Operating	Capital	Total
Acustar	Etobicoke	11.8	21.0	32.8
Bowmanville	Bowmanville	8.7	0.1	8.8
Canron	Hamilton	52.5	2.2	54.7
Fahramet	Orillia	16.5	6.6	23.1
Ford	Windsor	316.1	180.0	496.1
Franklin	Strathroy	16.4	2.3	18.7
G.M.	St. Catharines	200.1	238.0	438.1
Haley	Haley Station	271.3	50.0	321.3
Magalloy	Stratford	7.7	0.1	7.8
Richmond	Cornwall	13.6	0.2	13.8
A.H Tallman	Burlington	14.8	0.2	15.0
Western	Wingham	14.6	0.2	14.8
	Total	944.1	500.9	1445.0

TABLE 10: IMPACT OF MONITORING COSTS ON SELECTED FINANCIAL INDICATORS (1982-1987)

PLANT	CAPITAL EXPENDITURES Monitoring Capital Cost as a % of Annual Average Capital Expenditure			AFTER-TAX EARNINGS Monitoring Operating Cost as a % of Annual Average After-Tax Earnings (Loss)		
	Highest Year	**Lowest Year**	**Average Over 1982-87**	**Highest Year**	**Lowest Year**	**Average Over 1982-87**
Bowmanville	0.075	10.000	0.200	5.404	(15.263)	12.609
Canron	0.010	0.040	0.018	0.348	(0.155)	14.189
Chrysler U.S. (Acustar)	0.005	0.001	0.001	0.000	0.006	0.001
Falconbridge (Fahramet)	0.006	0.038	0.013	0.043	(0.019)	(0.159)
Franklin U.S.	0.096	0.044	0.056	0.168	0.289	0.224
Ford	0.042	0.078	0.062	0.106	(0.293)	0.258
General Motors	0.018	0.089	0.041	0.023	(0.279)	0.038
Haley	1.178	5.701	2.385	4.211	13.464	7.699
Haley (1 sample pt.)	-	-	-	2.105	6.730	3.848

Source: Economic Implications of the MISA Monitoring Regulation on Ontario's Metal Casting Sector, 1989.

APPENDIX C

FIGURES

FIGURE 1 - ACUSTAR CANADA INC

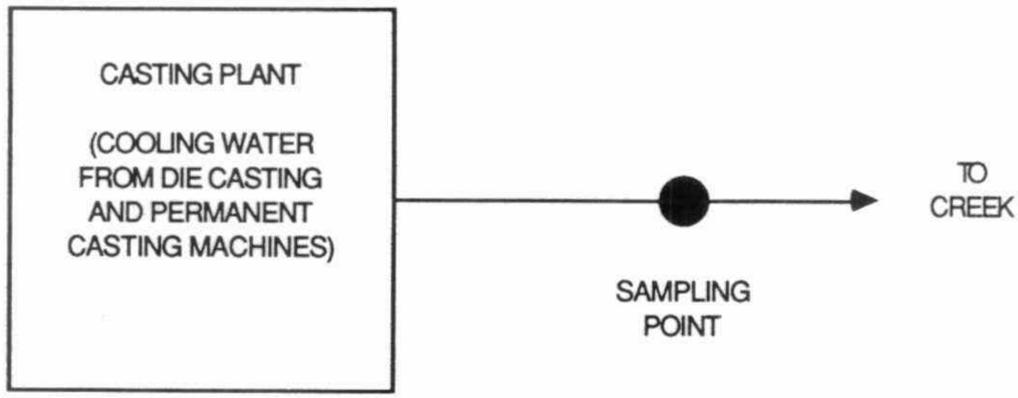


FIGURE 2 - THE BOWMANVILLE FOUNDRY CO. LTD

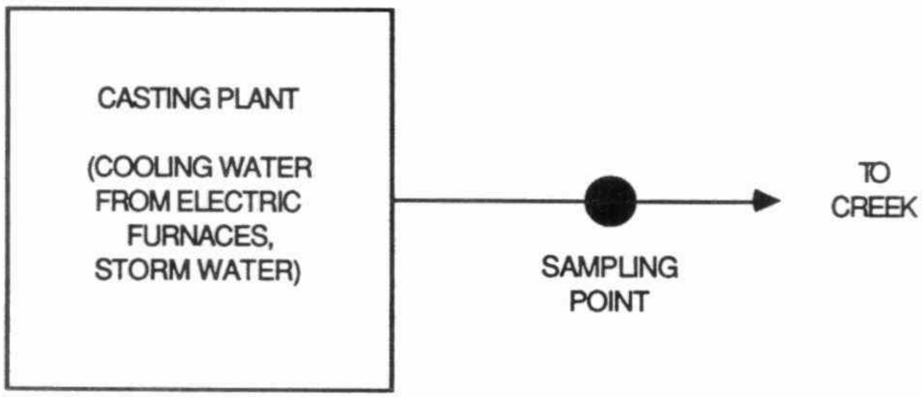
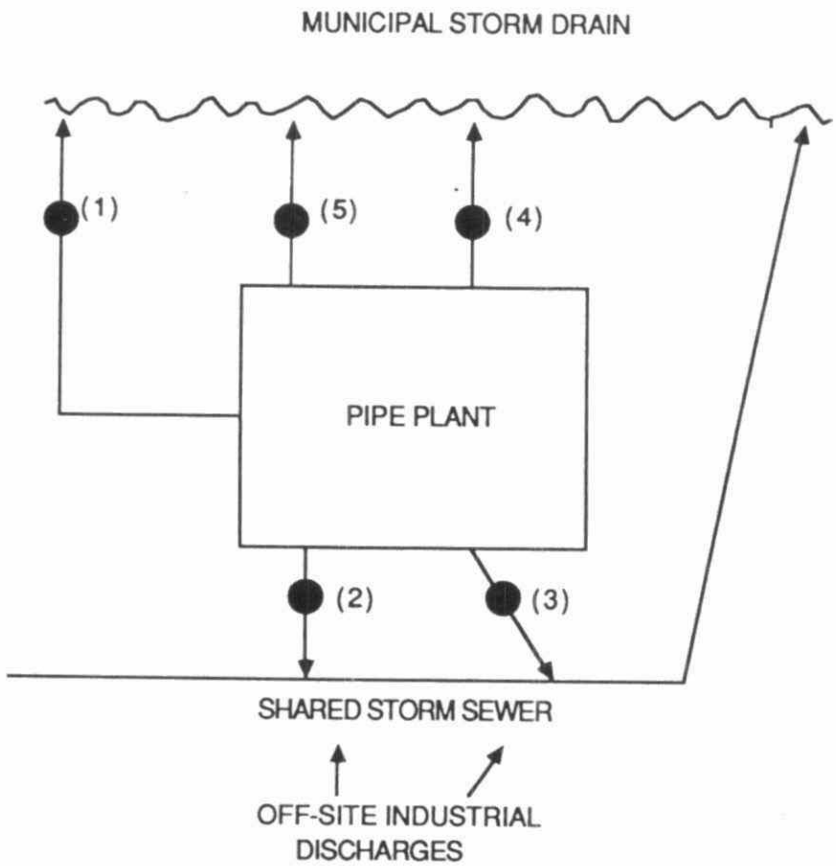


FIGURE 3 - CANRON INC., PIPE DIVISION



SAMPLING POINTS

(1) South Storm Sewer

- floor drains from curing bay
- storm water from non-process area

(2) Cement Lining Sump Pit Effluent

- floor drains from cement lining area

(3) Cupola Scrubber Sump Pit Effluent

- cooling water from cupola shell and induction furnaces
- slag quench tank and cupola scrubber tank overflows

(4) Accubar Effluent

- cooling water from continous casting die

(5) Main Floor Drain Sump Pit Effluent

- cooling water from centrifugal casting machines

FIGURE 4- FAHRAMET STEEL CASTINGS

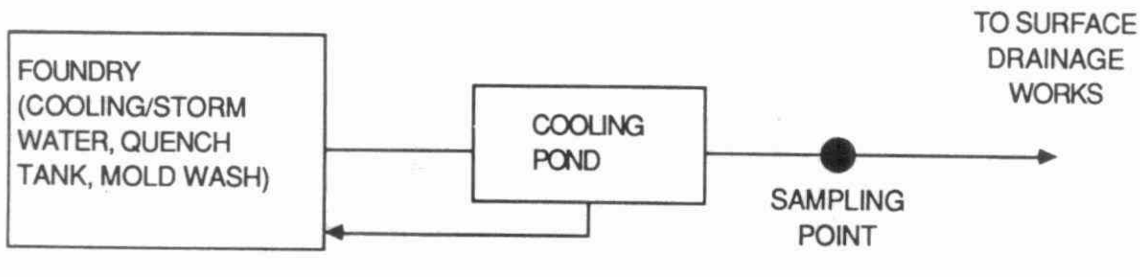


FIGURE 5 - FORD MOTOR COMPANY OF CANADA LTD

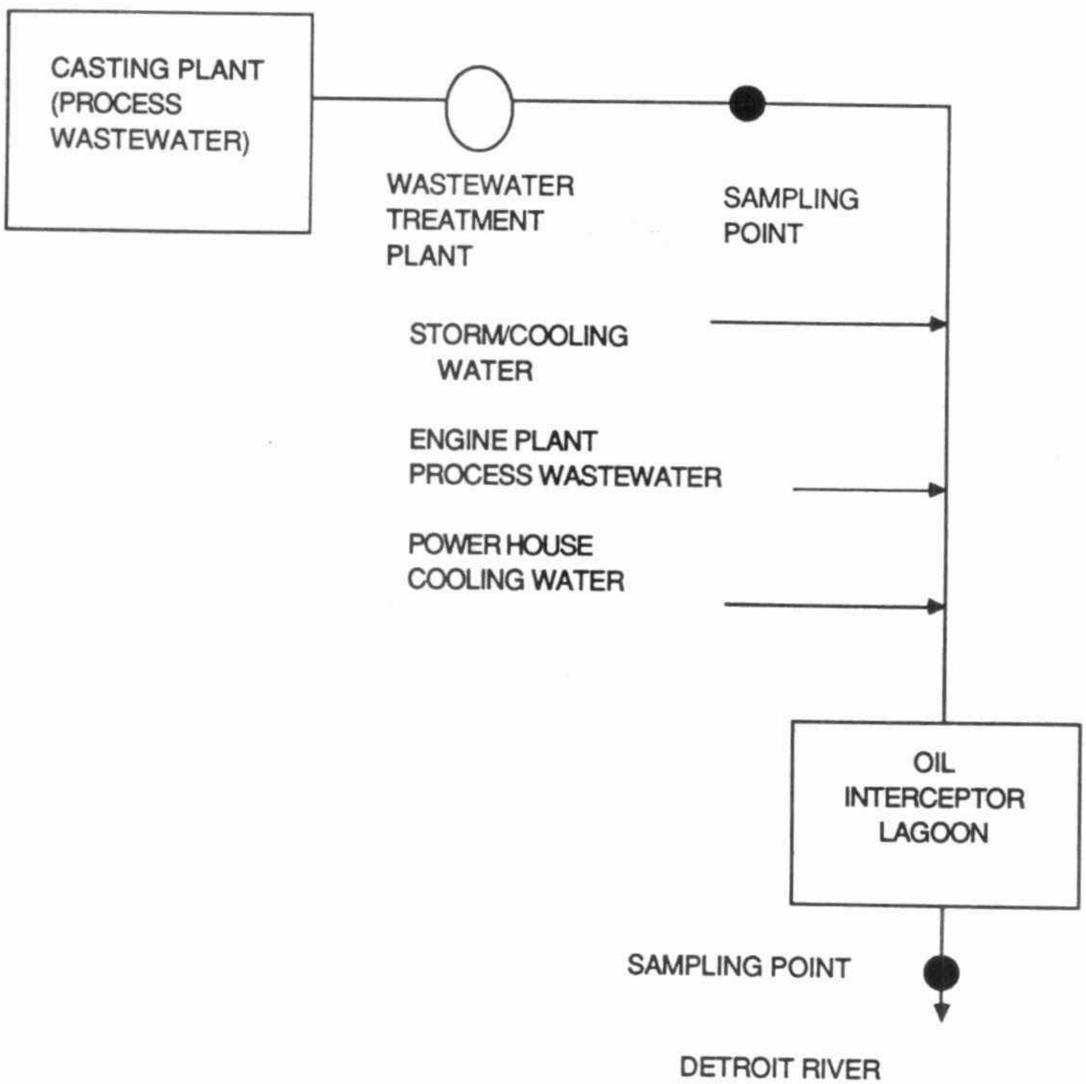


FIGURE 6 - FRANKLIN ELECTRIC OF CANADA LTD

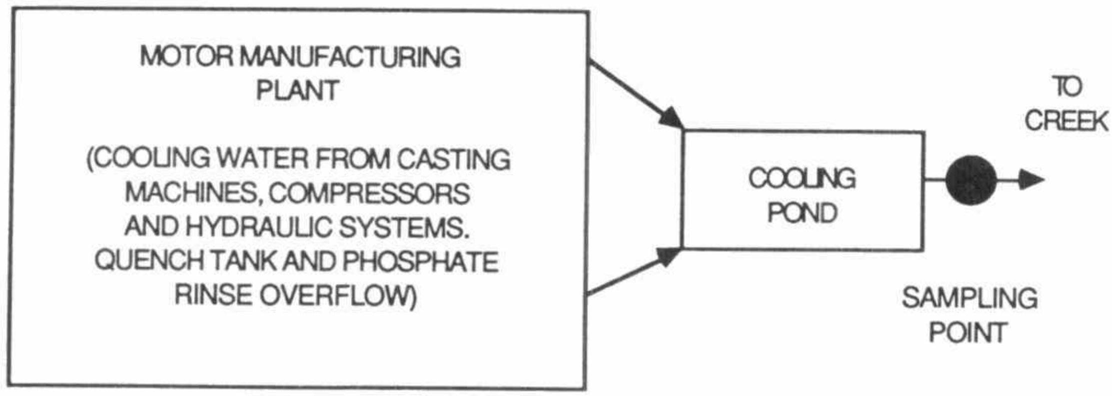
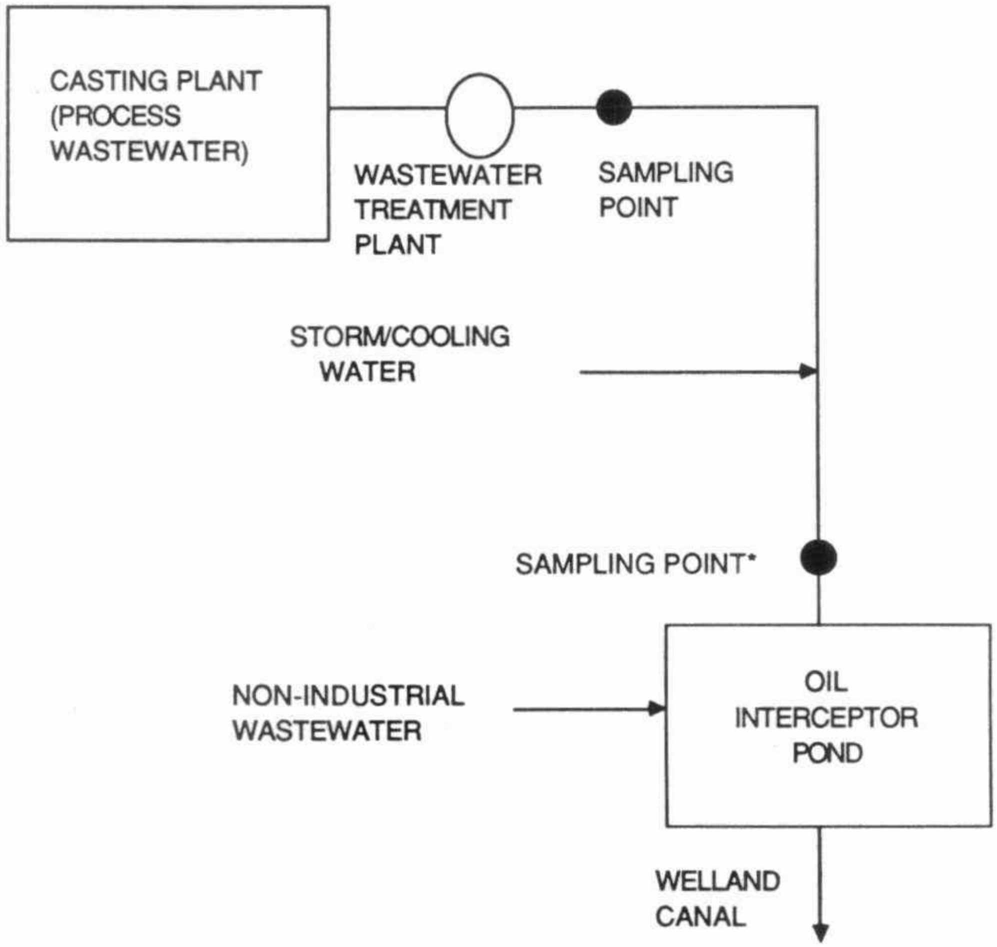


FIGURE 7 - GENERAL MOTORS OF CANADA LTD



* - tentative pending outcome of study on oil interceptor pond

FIGURE 8 - HALEY INDUSTRIES LTD

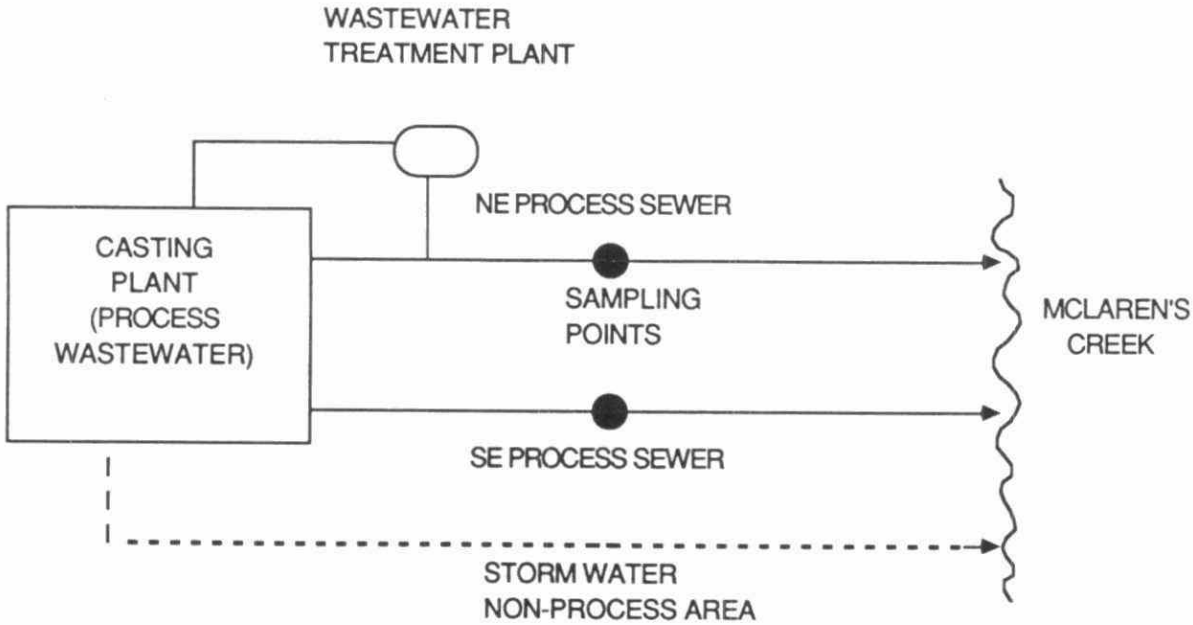


FIGURE 9 - MAGALLOY LTD

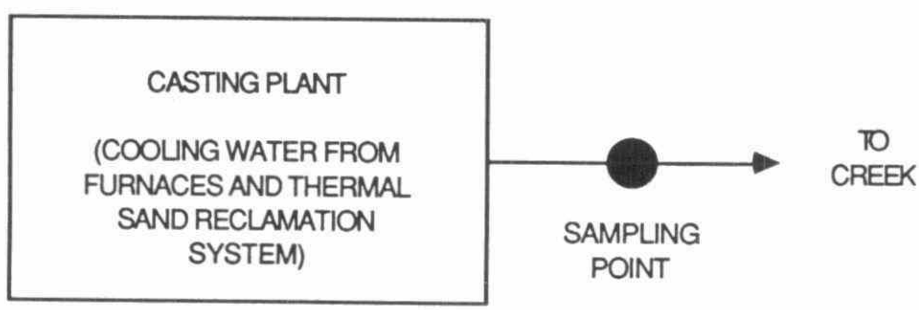


FIGURE 10 - RICHMOND DIE CASTING LTD

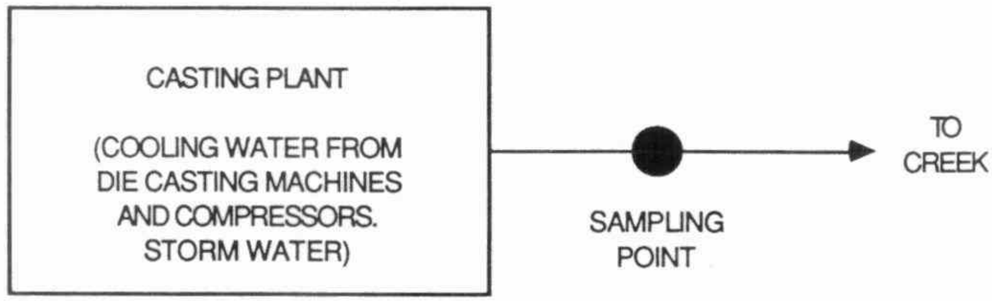


FIGURE 11 - A.H. TALLMAN BRONZE COMPANY LIMITED

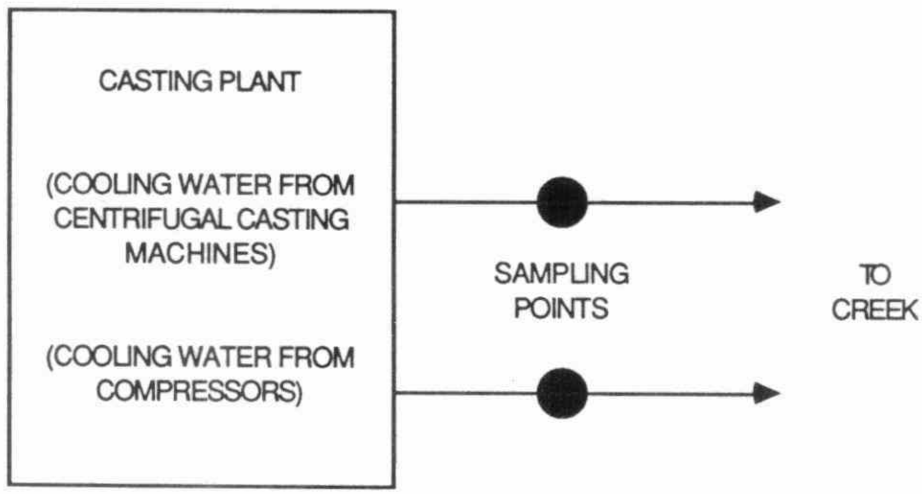
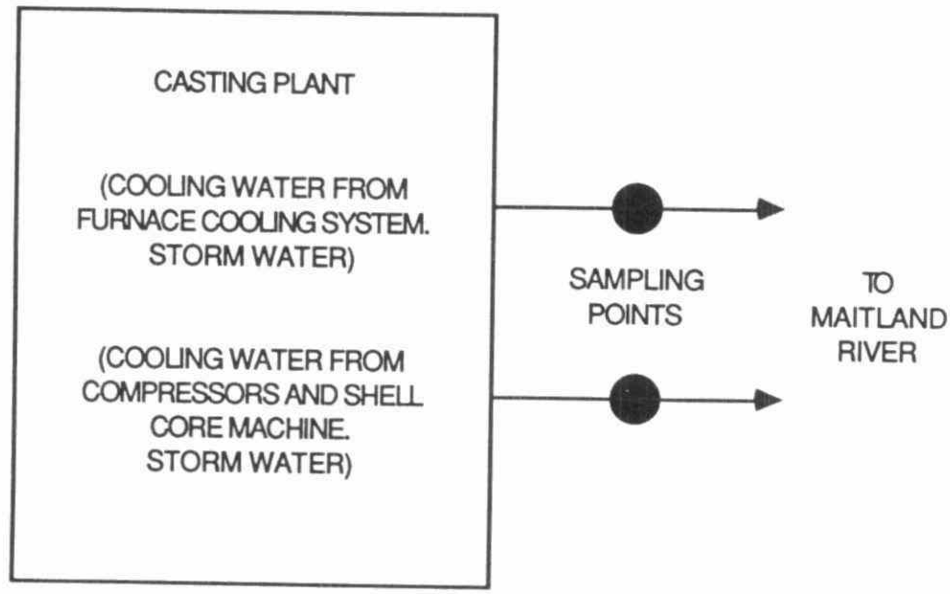


FIGURE 12 - WESTERN FOUNDRY COMPANY LIMITED



PART III

THE DRAFT EFFLUENT MONITORING REGULATION
FOR THE
METAL CASTING SECTOR

PART III - THE DRAFT EFFLUENT MONITORING REGULATION FOR THE METAL CASTING SECTOR

TABLE OF CONTENTS

DEFINITIONS

1.-(1) In this Regulation;

"characterization" means the analysis of a sample to identify and quantify all of the parameters in Schedule AA or Schedule BB;

"combined effluent" means any effluent resulting from the intentional combination of process effluent with cooling water effluent and may contain storm water;

"cooling water effluent" means cooling water that is discharged directly to a surface watercourse as an effluent;

"cooling water effluent stream" means a cooling water effluent which flows through an open or closed channel;

"cooling water effluent sampling point" means a location in a cooling water effluent stream situated before the place of discharge to a surface watercourse and after all building floor drain connections;

"General Effluent Monitoring Regulation" means Ontario Regulation 695/88;

"grab sample" means a volume of effluent of at least 100 millilitres which is collected over a period not exceeding fifteen minutes and immediately transferred to the appropriate laboratory sample container set out in Column 2 of Schedule 2 of the General Effluent Monitoring Regulation and Column 2 of Schedule CC of this Regulation;

"process change" means any change in equipment, production process, raw materials or treatment process;

(2) The definitions in section 1 of the General Effluent Monitoring Regulation that are not redefined in this Regulation, apply to this Regulation.

(3) In construing the General Effluent Monitoring Regulation, "plant" includes the facilities and developed property of the direct dischargers named in subsection 3(2).

PURPOSE

2. The purpose of this Regulation is to establish a data base on effluent quality in the metal casting sector that, along with other pertinent information, will be used in the development of effluent limits for the metal casting sector and to quantify the mass loadings of monitored contaminants being discharged into surface watercourses.

APPLICATION

3.-(1) This Regulation applies only with respect to the direct dischargers listed in subsection (2).

(2) The respective site-specific monitoring schedule for each direct discharger in the metal casting sector at the plant location named is as follows:

Schedule	Owner as of January 1, 1989	Location
A	Acustar Canada Inc.	Etobicoke
B	The Bowmanville Foundry Co. Limited	Bowmanville
C	Canron Inc., Pipe Division	Hamilton
D	Fahramet Steel Castings, Indusmin Division of Falconbridge Limited	Orillia
E	Ford Motor Company of Canada Limited	Windsor
F	Franklin Electric of Canada Ltd	Strathroy
G	General Motors of Canada Limited	St. Catharines
H	Haley Industries Limited	Haley Station
I	Magalloy Ltd	Stratford
J	Richmond Die Casting Ltd	Cornwall
K	A. H. Tallman Bronze Company Ltd	Burlington
L	Western Foundry Company Limited	Wingham

(3) This Regulation is a Sectoral Effluent Monitoring Regulation within the meaning of the General Effluent Monitoring Regulation.

(4) Each direct discharger shall carry out the monitoring obligations, including the sampling, analysis, toxicity testing, flow measurement, recording and reporting obligations of this Regulation in accordance with the General Effluent Monitoring Regulation and in accordance with the analytical principles listed in Schedules CC and DD of this Regulation.

(5) An obligation on a direct discharger to do a thing under this Regulation is discharged if another person has done it on the direct discharger's behalf.

(6) Each direct discharger shall notify the Director in writing of any change of name or ownership of its plant within thirty days after the day this Regulation comes into force or within thirty days after any such change.

SAMPLING

4.-(1) Each direct discharger shall establish a sampling point on each effluent stream specified in the respective site-specific monitoring schedule.

(2) Each direct discharger shall use the sampling points established under subsection (1) for all sampling required by this Regulation except that a direct discharger may use alternate sampling points where that is acceptable to the Director.

(3) Each direct discharger shall notify the Director in writing within thirty days of a change in the classification of an effluent stream and the Director may specify the parameters to be monitored and the monitoring frequency for that effluent stream.

CHARACTERIZATION AND OPEN CHARACTERIZATION

5.-(1) Each direct discharger shall collect a set of samples sufficient to perform the characterization analyses required by subsection (3) from each effluent sampling point on each effluent stream designated for characterization of that discharger,

(a) at the frequency specified in the respective site-specific monitoring schedule;

(b) once within thirty days after every process change that is expected to significantly affect the chemical composition of that effluent.

(2) Each direct discharger shall collect each set of samples required to be collected under subsection (3) not earlier than six weeks and not later than four months after the previous collection.

(3) Each direct discharger shall perform characterization analyses on each set of samples collected under subsection (1) for the parameters in each analytical test group listed in the respective Schedule AA or Schedule BB for that discharger.

(4) Each direct discharger shall collect a set of samples on the

same day that a set of samples are collected under subsection (1), sufficient to perform the open characterization analyses required by subsection (5) from each effluent sampling point on each effluent stream designated for open characterization of that discharger,

(a) at the frequency specified in the respective site-specific monitoring schedule;

(b) once within thirty days after every process change that is expected to significantly affect the chemical composition of that effluent.

(5) Each direct discharger shall perform open characterization analyses on each set of samples collected under subsection (4).

DAILY MONITORING - PROCESS EFFLUENT AND COMBINED EFFLUENT

6.-(1) During each operating day, each direct discharger shall collect a set of samples sufficient to perform all of the analyses required by subsection (3) from each process effluent sampling point and combined effluent sampling point of that discharger.

(2) Subsection (1) does not apply in respect of any day in which a sufficient volume of sample cannot be collected because of the collection of inspection samples.

(3) Each direct discharger shall analyze each set of samples collected under subsection (1) for the parameters specified in the column marked 'D' for the respective effluent stream in the respective site-specific monitoring schedule.

THRICE WEEKLY MONITORING - PROCESS EFFLUENT AND COMBINED EFFLUENT

7.-(1) On at least three separate operating days in each week, each direct discharger shall collect a set of samples sufficient to perform all of the analyses required by subsection (3) from each process effluent sampling point and combined effluent sampling point of that discharger.

(2) Pursuant to subsection (1), each direct discharger shall collect the sets of samples on different days of the week such that in any six week period a minimum number of two samples shall be collected for each routine operating day of the week.

(3) Each direct discharger shall analyze each set of samples collected under subsection (1) for the parameters specified in the column marked 'TW' for the respective effluent stream in the respective site-specific monitoring schedule.

WEEKLY MONITORING - PROCESS EFFLUENT AND COMBINED EFFLUENT

8.-(1) On at least one operating day in each week on the same day that a set of samples are collected under subsection 7(1) for that effluent stream, each direct discharger shall collect a set of samples sufficient to perform all of the analyses required by subsection (3) from each process effluent sampling point and combined effluent sampling point of that discharger.

(2) Each direct discharger shall collect each set of samples required to be collected under subsection (1) not earlier than four days after the previous collection.

(3) Each direct discharger shall analyze each set of samples collected under subsection (1) for the parameters specified in the column marked 'W' for the respective effluent stream in the respective site-specific monitoring schedule.

MONTHLY MONITORING - PROCESS EFFLUENT AND COMBINED EFFLUENT

9.-(1) On at least one operating day in each month on the same day that a set of samples are collected under subsection 8(1), each direct discharger shall collect a set of samples with sufficient volume to perform all of the analyses required by subsection (3) from each process effluent sampling point and combined effluent sampling point of that discharger.

(2) Each direct discharger shall collect each set of samples required to be collected under subsection (1) not earlier than two weeks after the previous collection.

(3) Each direct discharger shall analyze each set of samples collected under subsection (1) for the parameters specified in the column marked 'M' for the respective effluent stream in the respective site-specific monitoring schedule.

MONTHLY AND QUARTERLY MONITORING - COOLING WATER EFFLUENT

10.-(1) On at least one operating day in each month, each direct discharger shall collect a set of samples sufficient to perform all of the analyses required by subsection (3) from each cooling water effluent sampling point of that discharger.

(2) Each direct discharger shall collect each set of samples

required to be collected under subsection (1) not earlier than two weeks after the previous collection.

(3) Each direct discharger shall analyze each set of samples collected under subsection (1) for the parameters specified in the column marked 'M' for the respective cooling water effluent stream in the respective site-specific monitoring schedule.

(4) On at least one operating day in each quarter, each direct discharger shall collect a set of samples sufficient to perform all of the analyses required by subsection (6) from each cooling water effluent sampling point of that discharger.

(5) Each direct discharger shall collect each set of samples required to be collected under subsection (4) not earlier than six weeks and not later than four months after any previous collection.

(6) Each direct discharger shall analyze each set of samples collected under subsection (4) for the parameters specified in the column marked 'Q' for the respective cooling water effluent stream in the respective site-specific monitoring schedule.

MONTHLY AND QUARTERLY MONITORING - STORM WATER EFFLUENT

11.-(1) On at least one operating day in each month, each direct discharger shall collect during a storm water discharge, a set of samples from each storm water sampling point of that discharger sufficient to perform all of the analyses required by subsection (4).

(2) Subsection (1) does not apply in any month where no storm water discharge occurs.

(3) For the purposes of subsection (1) and subsection (4) where a direct discharger has been unable to collect a set of samples from a storm water sampling point of that discharger during any month, that discharger shall collect a compensating set of samples during a subsequent storm event or thaw for which a set of samples is not collected under subsection (1) sufficient to perform all of the analyses required in the respective site specific monitoring schedule for the respective storm water effluent stream.

(4) Each direct discharger shall analyze each set of samples collected under subsections (1) or (3) for the parameters specified in the column marked 'M' for the respective storm water effluent stream in the respective site-specific monitoring schedule.

(5) On at least one operating day in each quarter, each direct discharger shall collect during a storm water discharge, a set of samples from each storm water sampling point of that discharger sufficient to perform all of the analyses required by subsection (7).

(6) Each direct discharger shall collect each set of samples required to be collected under subsection (5) not earlier than six weeks and not later than four months after any previous collection.

(7) Each direct discharger shall analyze each set of samples collected under subsection (7) for the parameters specified in the column marked 'Q' for the respective cooling water effluent stream in the respective site-specific monitoring schedule.

QUALITY CONTROL MONITORING

12-(1) For the purposes of this section, "quality control samples" means,

(a) one duplicate sample for each sample collected under sections 6 to 9 for analysis for parameters in each analytical test group in Column 2 of Schedule AA;

(b) one travelling blank sample for each sample collected under sections 6 to 9 for analysis for parameters in each analytical test group in Column 2 of Schedule AA, except groups 1, 3 and 8; and

(c) one travelling spiked blank sample for each sample collected under sections 6 to 9 for analysis for parameters in analytical test groups 16 to 24, 26 and 27 in Column 2 of Schedule AA.

(2) Each direct discharger shall prepare each travelling spiked blank sample required to be analyzed by this section with a standard solution containing at least the parameters to be analyzed for.

(3) Each direct discharger shall collect quality control samples from one process effluent sampling point of that discharger once in each month concurrent with the sampling required by sections 6 and 7 and shall analyze the samples for the parameters specified in the columns marked 'D' and 'TW' for the respective effluent stream in the respective site-specific monitoring schedule.

(4) Each direct discharger shall collect quality control samples from one process effluent sampling point of that discharger once in each quarter concurrent with the sampling required by sections 8 and 9 and shall analyze the samples for the parameters specified in the columns marked 'W' and 'M' for the respective effluent stream in the respective site-specific monitoring schedule.

TOXICITY TESTING

13.-(1) Each direct discharger shall collect a sample from each process effluent sampling point and each combined effluent sampling point on each process effluent stream and combined effluent stream designated for toxicity testing in the respective site-specific monitoring schedule of that discharger once in each month on the same day as one of the sets of samples required by section 9 is collected, and shall perform a fish toxicity test on each of the samples required by this subsection.

(2) If the tests performed under subsection (1) in three consecutive months result in mortality for no more than two out of ten fish at all effluent concentrations, a direct discharger may thereafter collect the samples and perform the tests required by subsection (1) on 100 percent undiluted test solution only.

(3) If a test performed under subsection (2) results in mortality for more than two out of ten fish, subsection (2) ceases to apply and continues not to apply until the tests performed under subsection (1) in a further three consecutive months result in mortality for no more than two out of ten fish at all effluent concentrations.

(4) Each direct discharger shall collect a sample from each process effluent sampling point and each combined effluent sampling point on each process effluent stream and each combined effluent stream designated for toxicity testing in the respective site-specific monitoring schedule of that discharger once in each month on the same day as one of the sets of samples required by subsection (1) is collected, and shall perform thereon a Daphnia magna acute lethality toxicity test.

(5) Each direct discharger shall collect the sample required by subsection (4) together in the same container or set of containers with the fish toxicity test sample.

(6) Each direct discharger shall collect a sample from each cooling water effluent sampling point on each cooling water effluent stream designated for toxicity testing in the respective site-specific monitoring schedule of that discharger once in each quarter on the same day as one of the sets of samples required by section 5 is collected from that sampling point and shall perform, on each of the samples required by this subsection,

(a) a fish toxicity test; and

(b) a Daphnia magna acute lethality toxicity test.

FLOW MEASUREMENT

14.-(1) Each direct discharger shall continuously measure the flow of each process effluent stream and combined effluent stream of that discharger at a location or set of locations representative of the flow at the sampling point established for that stream, and shall record the measured flow.

(2) Where the flow of a process effluent stream or combined effluent stream cannot be continuously measured on any day because of equipment malfunction and all reasonable care has been taken to avoid and correct the malfunction, the direct discharger may fulfil the requirement of subsection (1) by estimating the total volume of effluent discharged that operating day from that stream, recording that estimate and identifying it as such.

(3) Each direct discharger shall, at the time of each collection,

(a) measure or estimate the flow of each cooling water effluent stream of that discharger, and

(b) measure or estimate the duration and approximate volume of each discharge of storm water of that discharger,

at a location or set of locations representative of the flow at the sampling point established for that stream and shall record the measured or estimated flow.

EXTENDED MONITORING

15.-(1) Once every third operating day, each direct discharger shall collect a set of samples sufficient to perform all of the analyses required by subsection (2) from each process effluent sampling point and combined effluent sampling point of that discharger.

(2) Each direct discharger shall analyze each set of samples collected under subsection (1) for analytical test groups 3, 8 and 14.

16.-(1) On at least one operating day in each week on the same day that a set of samples are collected under subsection 15(1), each direct discharger shall collect a set of samples sufficient to perform all of the analyses required by subsection (2) from each process effluent sampling point and combined effluent sampling point of that discharger.

(2) Each direct discharger shall analyze each set of samples collected under subsection (1) for the parameters specified in the columns marked 'TW' and 'W' for the respective effluent stream in the respective site-specific monitoring schedule.

REPORTING

17.-(1) Within seven days after this subsection comes into force, each direct discharger shall submit an initial report to the Director in respect of that direct discharger's plant.

(2) Each direct discharger shall report any changes to the information submitted under subsection (1) to the Director within thirty days after the end of the month during which the change occurs.

(3) With respect to each sample, each direct discharger shall report to the Director the date on which the sample was collected, the method used to collect the sample and the results of all analyses performed by or on behalf of the direct discharger under sections 5 to 13, 15 and 16 of this Regulation and under subsection 4(10) of the General Regulation, including all positive numerical values at or above the analytical method detection limits calculated by the laboratory performing the analysis.

(4) Each direct discharger shall report to the Director the flow measurement information recorded in respect of each process effluent stream, combined effluent stream and cooling water effluent stream of that discharger and the date on which the flow was measured.

(5) Each direct discharger shall report to the Director the date and amount of rainfall during each day on which there is a storm event and the date, duration and volume for each discharge of storm water to a surface watercourse for which a set of samples is collected under section 11.

(6) Each direct discharger shall submit the reports referred to in subsections (4) and (5) to the Director in writing within sixty days after the day on which the information was recorded.

(7) Except for samples collected under section 11, at least thirty days before the collection of the first sample in each month, each direct discharger shall submit to the Director a schedule of sampling dates and times by location for all monthly and quarterly sampling in that month.

(8) Each direct discharger shall follow the schedule submitted by the direct discharger under subsection (7) but if the schedule cannot be followed as submitted, the direct discharger shall notify the Director immediately of any change in dates or times.

(9) Within thirty days after the end of each quarter, each direct discharger shall submit a report to the Director summarizing the quantities of chemicals added to cooling water in that quarter and stating the dates on which these additions occurred.

(10) No later than one year after this section comes into force, each direct discharger shall submit a report to the Director describing the variation in daily flow for a period of six months for each process effluent stream and combined effluent stream from which samples are collected other than by means of an automatic flow proportional composite sampling device.

(11) The report referred to in subsection (10) shall include the raw data and calculation methods used to produce the report.

(12) If a report required to be submitted to the Director under subsection (10) establishes that there is variable flow in any process effluent stream or combined effluent stream, then commencing three months after the date of submission of the report, the direct discharger shall collect each sample from the process effluent sampling point or combined effluent sampling point of that stream only in accordance with clause 3(4)(a), (b) or (e) of the General Effluent Monitoring Regulation.

(13) If a report described in subsection (10) is not submitted to the Director, then commencing three months after the report was due, the process effluent stream or combined effluent stream of the direct discharger, shall be deemed to be a variable flow stream and the direct discharger shall collect each sample from that stream only in accordance with clause 3(4)(a), (b) or (e) of the General Effluent Monitoring Regulation.

(14) Each direct discharger shall keep records of all sampling required by this Regulation, including, for each sample, the date and time of collection, sampling procedures used, the amount of sample dilution by preservative if dilution exceeds one per cent, and any incident likely to affect an analytical result.

(15) Each direct discharger shall develop a maintenance and calibration schedule for all sampling equipment and shall record the results of all maintenance and calibration performed.

(16) Each direct discharger shall keep records of all analytical methods used.

(17) Each direct discharger shall submit a report to the Director detailing the date, duration and cause of each sampling, toxicity testing, analytical and flow measurement malfunction or other problem, and remedial action taken, within sixty days after the day on which the malfunction or problem occurs.

(18) Each direct discharger shall keep for two years all records and reports required by this Regulation to be kept or made.

TIMING

18.-(1) This Regulation, except sections 15 and 16 and subsection 17(1), comes into force on the 1st day of the sixth month following filing.

(2) Subsection 17(1) comes into force on the 1st day of the fourth month following filing.

(3) Sections 5 to 13 and 17(5) are revoked one year after the day this Regulation comes into force.

(4) Sections 15 and 16 come into force one year after the day this Regulation comes into force.

(5) Sections 15 and 16 are revoked on the 1st day of the month following filing of the 'Effluent Limits Regulation for the Metal Casting Sector'.

LEGEND FOR SCHEDULES A to L and AA to DD

NOTE 1: Analyze for Hexavalent Chromium only if the total chromium concentration is greater than 1 milligram per litre.

NOTE 2: Analyze for Alkyl Leads only if the total lead concentration is greater than 1 milligram per litre.

NOTE 3: Follow the Sampling & Analytical Principles outlined for Analytical Test Group 19 in Schedule 2 and in Part B of Schedule 3 in the General Effluent Monitoring Regulation with an Analytical Detection Limit of 0.6 micrograms per litre.

NOTE 4: Follow the Sampling & Analytical Principles outlined for Analytical Test Group 19 in Schedule 2 and in Part B of Schedule 3 in the General Effluent Monitoring Regulation with an Analytical Detection Limit of 0.4 micrograms per litre.

NOTE 5: Analyze for Chlorinated Dibenzo-p-dioxins and Dibenzofurans during the first and third quarter only.

NOTE 6: Analyze for PCBs if used or stored on-site.

D - Daily

TW - Thrice weekly

W - Weekly

M - Monthly

Q - Quarterly

SA - Semi-annually

† Analytical Test Group to be monitored in accordance with the Sampling Principles listed in Schedule CC and the Analytical Principles and Analytical Method Detection Limits listed in Schedule DD.

SCHEDULE AA - CHARACTERIZATION MONITORING PARAMETERS - METAL CASTING SECTOR

	COLUMN 1	COLUMN 2	COLUMN 3
ANALYTICAL TEST GROUP		PARAMETERS	CAS #s
#	NAME		
1	Chemical Oxygen Demand	Chemical oxygen demand (COD)	N/A
2	Total cyanide	Total cyanide	57-12-5
3	Hydrogen ion (pH)	Hydrogen ion (pH)	N/A
4a	Nitrogen	Ammonia plus Ammonium	N/A
		Total Kjeldahl nitrogen	N/A
4b		Nitrate + Nitrite	N/A
5a	Organic carbon	Dissolved organic carbon (DOC)	N/A
5b		Total organic carbon (TOC)	N/A
6	Total phosphorus	Total phosphorus	7723-14-0
7	Specific conductance	Specific conductance	N/A
8	Suspended solids	Total suspended solids (TSS)	N/A
		Volatile suspended solids (VSS)	N/A
9	Total metals	Aluminum	7429-90-5
		Beryllium	7440-41-7
		Cadmium	7440-43-9
		Chromium	7440-47-3
		Cobalt	7440-48-4
		Copper	7440-50-8
		Lead	7439-92-1
		Molybdenum	7439-98-7
		Nickel	7440-02-0
		Silver	7440-22-4
		Thallium	7440-28-0
		Vanadium	7440-62-2
		Zinc	7440-66-6
10	Hydrides	Antimony	7440-36-0
		Arsenic	7440-38-2
		Selenium	7782-49-2
11	Chromium (Hexavalent) (NOTE 1)	Chromium (Hexavalent)	7440-47-3
12	Mercury	Mercury	7439-97-6

COLUMN 1		COLUMN 2	COLUMN 3
ANALYTICAL TEST GROUP		PARAMETERS	CAS #s
#	NAME		
13	Total alkyl lead (NOTE 2)	Tetra-ethyl lead	78-00-2
		Tri-ethyl lead	N/A
14	Phenolics (4AAP)	Phenolics (4AAP)	N/A
15	Sulphide	Sulphide	N/A
16	Volatiles, Halogenated	1,1,2,2-Tetrachloroethane	79-34-5
		1,1,2-Trichloroethane	79-00-5
		1,1-Dichloroethane	75-34-3
		1,1-Dichloroethylene	75-35-4
		1,2-Dichlorobenzene	95-50-1
		1,2-Dichloroethane (Ethylene dichloride)	107-06-2
		1,2-Dichloropropane	78-87-5
		1,3-Dichlorobenzene	541-73-1
		1,4-Dichlorobenzene	106-46-7
		Bromoform	75-25-2
		Bromomethane	74-83-9
		Carbon tetrachloride	56-23-5
		Chlorobenzene	108-90-7
		Chloroform	67-66-3
		Chloromethane	74-87-3
		Cis-1,3-Dichloropropylene	10061-01-5
		Dibromochloromethane	124-48-1
		Ethylene dibromide	106-93-4
		Methylene chloride	75-09-2
		Tetrachloroethylene (Perchloroethylene)	127-18-4
		Trans-1,2-Dichloroethylene	156-60-5
		Trans-1,3-Dichloropropylene	10061-02-6
		Trichloroethylene	79-01-6
		Trichlorofluoromethane	75-69-4
		Vinyl chloride (Chloroethylene)	75-01-4
17	Volatiles, Non-Halogenated	Benzene	71-43-2
		Styrene	100-42-5
		Toluene	108-88-3
		o-Xylene	95-47-6
		m-Xylene and p-Xylene	108-38-3
			& 106-42-3
18	Volatiles, Water Soluble	Acrolein	107-02-8
		Acrylonitrile	107-13-1

SCHEDULE AA - CHARACTERIZATION MONITORING PARAMETERS - METAL CASTING SECTOR

COLUMN 1		COLUMN 2	COLUMN 3
ANALYTICAL TEST GROUP		PARAMETERS	CAS #s
#	NAME		
19	Extractables, Base Neutral	Acenaphthene	83-32-9
		5-nitro Acenaphthene	602-87-9
		Acenaphthylene	208-96-8
		Anthracene	120-12-7
		Benz(a)anthracene	56-55-3
		Benzo(a)pyrene	50-32-8
		Benzo(b)fluoranthene	205-99-2
		Benzo(g,h,i)perylene	191-24-2
		Benzo(k)fluoranthene	207-08-9
		Biphenyl (NOTE 3)	92-52-4
		Camphene	79-92-5
		1-Chloronaphthalene	90-13-1
		2-Chloronaphthalene	91-58-7
		Chrysene	218-01-9
		Dibenz(a,h)anthracene	53-70-3
		Fluoranthene	206-44-0
		Fluorene	86-73-7
		Indeno(1,2,3-cd)pyrene	193-39-5
		Indole	120-72-9
		1-Methylnaphthalene	90-12-0
		2-Methylnaphthalene	91-57-6
		Naphthalene	91-20-3
		Perylene	198-55-0
		Phenanthrene	85-01-8
		Pyrene	129-00-0
		Benzyl butyl phthalate	85-68-7
		Bis(2-ethylhexyl) phthalate	117-81-7
		Di-n-butyl phthalate	84-74-2
		4-Bromophenyl phenyl ether	101-55-3
		4-Chlorophenyl phenyl ether	7005-72-3
		Bis(2-chloroisopropyl)ether	108-60-1
		Bis(2-chloroethyl)ether	111-44-4
		Diphenyl ether (NOTE 4)	10-184-8
		2,4-Dinitrotoluene	121-14-2
		2,6-Dinitrotoluene	606-20-2
		Bis(2-chloroethoxy)methane	111-91-1
		Diphenylamine	122-39-4
		N-Nitrosodiphenylamine	86-30-6
		N-Nitrosodi-n-propylamine	621-64-7

SCHEDULE AA - CHARACTERIZATION MONITORING PARAMETERS - METAL CASTING SECTOR

COLUMN 1		COLUMN 2	COLUMN 3
ANALYTICAL TEST GROUP #	NAME	PARAMETERS	CAS #s
20	Extractables, Acid (Phenolics)	2,3,4,5-Tetrachlorophenol	4901-51-3
		2,3,4,6-Tetrachlorophenol	58-90-2
		2,3,5,6-Tetrachlorophenol	935-95-5
		2,3,4-Trichlorophenol	15950-66-0
		2,3,5-Trichlorophenol	933-78-8
		2,4,5-Trichlorophenol	95-95-4
		2,4,6-Trichlorophenol	88-06-2
		2,4-Dimethyl phenol	105-67-9
		2,4-Dinitrophenol	51-28-5
		2,4-Dichlorophenol	120-83-2
		2,6-Dichlorophenol	87-65-0
		4,6-Dinitro-o-cresol	534-52-1
		2-Chlorophenol	95-57-8
		4-Chloro-3-methylphenol	59-50-7
		4-Nitrophenol	100-02-7
		m-Cresol	108-39-4
		o-Cresol	95-48-7
		p-Cresol	106-44-5
		Pentachlorophenol	87-86-5
		Phenol	108-95-2
23	Extractables, Neutral -Chlorinated	1,2,3,4-Tetrachlorobenzene	634-66-2
		1,2,3,5-Tetrachlorobenzene	634-90-2
		1,2,4,5-Tetrachlorobenzene	95-94-3
		1,2,3-Trichlorobenzene	87-61-6
		1,2,4-Trichlorobenzene	120-82-1
		2,4,5-Trichlorotoluene	6639-30-1
		Hexachlorobenzene	118-74-1
		Hexachlorobutadiene	87-68-3
		Hexachlorocyclopentadiene	77-47-4
		Hexachloroethane	67-72-1
		Octachlorostyrene	29082-74-4
		Pentachlorobenzene	608-93-5
24	Chlorinated Dibenzo-p-dioxins and Dibenzofurans (NOTE 5)	2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6
		Octachlorodibenzo-p-dioxin	326-88-7
		Octachlorodibenzofuran	Unavailable
		Total heptachlorinated dibenzo-p-dioxins	Unavailable
		Total heptachlorinated dibenzofurans	Unavailable
		Total hexachlorinated dibenzo-p-dioxins	34465-46-8
		Total hexachlorinated dibenzofurans	Unavailable
		Total pentachlorinated dibenzo-p-dioxins	Unavailable
		Total pentachlorinated dibenzofurans	Unavailable
		Total tetrachlorinated dibenzo-p-dioxins	Unavailable
		Total tetrachlorinated dibenzofurans	Unavailable

SCHEDULE AA - CHARACTERIZATION MONITORING PARAMETERS - METAL CASTING SECTOR

	COLUMN 1	COLUMN 2	COLUMN 3
ANALYTICAL TEST GROUP #	NAME	PARAMETERS	CAS #s
25	Solvent Extractables	Oil and grease	
26†	Fatty and Resin Acids	Abietic acid	514-10-3
		Chlorodehydroabietic acid	61996-36-7
		Dehydroabietic acid	1740-19-8
		Isopimaric acid	5835-26-7
		Levopimaric acid	79-54-9
		Neoabietic acid	471-77-2
		Oleic acid	112-80-1
		Pimaric acid	127-27-5
27	Polychlorinated Biphenyls (PCBs) (Total)	PCBs (Total)	Unavailable
MC1†	Metals	Iron	7439-89-6
		Magnesium	7439-95-4
MC2†	Fluoride	Fluoride	N/A

SCHEDULE BB - CHARACTERIZATION MONITORING PARAMETERS - METAL CASTING SECTOR

COLUMN 1		COLUMN 2	COLUMN 3
ANALYTICAL TEST GROUP		PARAMETERS	CAS #s
#	NAME		
1	Chemical Oxygen Demand	Chemical oxygen demand (COD)	N/A
2	Total cyanide	Total cyanide	57-12-5
3	Hydrogen ion (pH)	Hydrogen ion (pH)	N/A
4a	Nitrogen	Ammonia plus Ammonium	N/A
		Total Kjeldahl nitrogen	N/A
4b		Nitrate + Nitrite	N/A
5a	Organic carbon	Dissolved organic carbon (DOC)	N/A
5b		Total organic carbon (TOC)	N/A
6	Total phosphorus	Total phosphorus	7723-14-0
7	Specific conductance	Specific conductance	N/A
8	Suspended solids	Total suspended solids (TSS)	N/A
		Volatile suspended solids (VSS)	N/A
9	Total metals	Aluminum	7429-90-5
		Beryllium	7440-41-7
		Cadmium	7440-43-9
		Chromium	7440-47-3
		Cobalt	7440-48-4
		Copper	7440-50-8
		Lead	7439-92-1
		Molybdenum	7439-98-7
		Nickel	7440-02-0
		Silver	7440-22-4
		Thallium	7440-28-0
		Vanadium	7440-62-2
		Zinc	7440-66-6
10	Hydrides	Antimony	7440-36-0
		Arsenic	7440-38-2
		Selenium	7782-49-2
11	Chromium (Hexavalent) (NOTE 1)	Chromium (Hexavalent)	7440-47-3
12	Mercury	Mercury	7439-97-6

COLUMN 1		COLUMN 2	COLUMN 3
ANALYTICAL TEST GROUP		PARAMETERS	CAS #s
#	NAME		
13	Total alkyl lead (NOTE 2)	Tetra-ethyl lead	78-00-2
		Tri-ethyl lead	N/A
14	Phenolics (4AAP)	Phenolics (4AAP)	N/A
15	Sulphide	Sulphide	N/A
16	Volatiles, Halogenated	1,1,2,2-Tetrachloroethane	79-34-5
		1,1,2-Trichloroethane	79-00-5
		1,1-Dichloroethane	75-34-3
		1,1-Dichloroethylene	75-35-4
		1,2-Dichlorobenzene	95-50-1
		1,2-Dichloroethane (Ethylene dichloride)	107-06-2
		1,2-Dichloropropane	78-87-5
		1,3-Dichlorobenzene	541-73-1
		1,4-Dichlorobenzene	106-46-7
		Bromoform	75-25-2
		Bromomethane	74-83-9
		Carbon tetrachloride	56-23-5
		Chlorobenzene	108-90-7
		Chloroform	67-66-3
		Chloromethane	74-87-3
		Cis-1,3-Dichloropropylene	10061-01-5
		Dibromochloromethane	124-48-1
		Ethylene dibromide	106-93-4
		Methylene chloride	75-09-2
		Tetrachloroethylene (Perchloroethylene)	127-18-4
		Trans-1,2-Dichloroethylene	156-60-5
		Trans-1,3-Dichloropropylene	10061-02-6
		Trichloroethylene	79-01-6
		Trichlorofluoromethane	75-69-4
		Vinyl chloride (Chloroethylene)	75-01-4
17	Volatiles, Non-Halogenated	Benzene	71-43-2
		Styrene	100-42-5
		Toluene	108-88-3
		o-Xylene	95-47-6
		m-Xylene and p-Xylene	108-38-3
			& 106-42-3
18	Volatiles, Water Soluble	Acrolein	107-02-8
		Acrylonitrile	107-13-1

SCHEDULE BB - CHARACTERIZATION MONITORING PARAMETERS - METAL CASTING SECTOR

COLUMN 1		COLUMN 2	COLUMN 3
ANALYTICAL TEST GROUP		PARAMETERS	CAS #s
#	NAME		
19	Extractables, Base Neutral	Acenaphthene	83-32-9
		5-nitro Acenaphthene	602-87-9
		Acenaphthylene	208-96-8
		Anthracene	120-12-7
		Benz(a)anthracene	56-55-3
		Benzo(a)pyrene	50-32-8
		Benzo(b)fluoranthene	205-99-2
		Benzo(g,h,i)perylene	191-24-2
		Benzo(k)fluoranthene	207-08-9
		Biphenyl (NOTE 3)	92-52-4
		Camphene	79-92-5
		1-Chloronaphthalene	90-13-1
		2-Chloronaphthalene	91-58-7
		Chrysene	218-01-9
		Dibenz(a,h)anthracene	53-70-3
		Fluoranthene	206-44-0
		Fluorene	86-73-7
		Indeno(1,2,3-cd)pyrene	193-39-5
		Indole	120-72-9
		1-Methylnaphthalene	90-12-0
		2-Methylnaphthalene	91-57-6
		Naphthalene	91-20-3
		Perylene	198-55-0
		Phenanthrene	85-01-8
		Pyrene	129-00-0
		Benzyl butyl phthalate	85-68-7
		Bis(2-ethylhexyl) phthalate	117-81-7
		Di-n-butyl phthalate	84-74-2
		4-Bromophenyl phenyl ether	101-55-3
		4-Chlorophenyl phenyl ether	7005-72-3
		Bis(2-chloroisopropyl)ether	108-60-1
		Bis(2-chloroethyl)ether	111-44-4
		Diphenyl ether (NOTE 4)	10-184-8
		2,4-Dinitrotoluene	121-14-2
		2,6-Dinitrotoluene	606-20-2
		Bis(2-chloroethoxy)methane	111-91-1
		Diphenylamine	122-39-4
		N-Nitrosodiphenylamine	86-30-6
		N-Nitrosodi-n-propylamine	621-64-7

SCHEDULE BB - CHARACTERIZATION MONITORING PARAMETERS - METAL CASTING SECTOR

	COLUMN 1	COLUMN 2	COLUMN 3
ANALYTICAL TEST GROUP		PARAMETERS	CAS #s
#	NAME		
20	Extractables, Acid (Phenolics)	2,3,4,5-Tetrachlorophenol	4901-51-3
		2,3,4,6-Tetrachlorophenol	58-90-2
		2,3,5,6-Tetrachlorophenol	935-95-5
		2,3,4-Trichlorophenol	15950-66-0
		2,3,5-Trichlorophenol	933-78-8
		2,4,5-Trichlorophenol	95-95-4
		2,4,6-Trichlorophenol	88-06-2
		2,4-Dimethyl phenol	105-67-9
		2,4-Dinitrophenol	51-28-5
		2,4-Dichlorophenol	120-83-2
		2,6-Dichlorophenol	87-65-0
		4,6-Dinitro-o-cresol	534-52-1
		2-Chlorophenol	95-57-8
		4-Chloro-3-methylphenol	59-50-7
		4-Nitrophenol	100-02-7
		m-Cresol	108-39-4
		o-Cresol	95-48-7
		p-Cresol	106-44-5
		Pentachlorophenol	87-86-5
		Phenol	108-95-2
25	Solvent Extractables	Oil and grease	
26†	Fatty and Resin Acids	Abietic acid	514-10-3
		Chlorodehydroabietic acid	61996-36-7
		Dehydroabietic acid	1740-19-8
		Isopimaric acid	5835-26-7
		Levopimaric acid	79-54-9
		Neoabietic acid	471-77-2
		Oleic acid	112-80-1
		Pimaric acid	127-27-5
27	Polychlorinated Biphenyls (PCBs) (Total)	PCBs (Total)	Unavailable
MC1†	Metals	Iron	7439-89-6
		Magnesium	7439-95-4
MC2†	Fluoride	Fluoride	N/A

SCHEDULE CC - SAMPLING PRINCIPLES

Column 1	Column 2	Column 3	Column 4	Col. 5	Column 6	Column 7
ANALYTICAL TEST GROUP	LABORATORY SAMPLE CONTAINER	LABORATORY CONTAINER PRE-TREATMENT	TEST SPECIFIC SAMPLING PRECAUTIONS	MIN. SAM. VOL.	PRESERVATION METHOD	MAX. STORAGE TIME (DAYS)
Fatty and Resin Acids						
26	Amber glass or fluorocarbon resin with fluorocarbon resin lined cap.	If pre-treatment necessary: Bottle: Sequence of extensive washing/hot water, detergent, water, distilled water. Bake at 300° C for 8 h minimum or 3 rinses with pesticide grade or distilled in glass hexane and dichloromethane. Cap: no pre-treatment.	Contact surfaces must be glass, fluorocarbon resin or stainless steel.	800mL	None	7
Metals						
MC1	Sample containers and caps/ liners must be composed only of one or more of the following materials: fluorocarbon resin, polyethylene terephthalate, glass, polystyrene, polypropylene, high or low density polyethylene. Metallic foil should not be used.	If pre-treatment necessary, soak overnight in a 5% solution of nitric acid (HNO_3), followed by several rinses in distilled water.	If sample is high (>5%) in hydrocarbons or organic solvents, use glass or fluorocarbon resin sample container only.	100mL	Add nitric acid (HNO_3) (containing <1 mg/L of all analytes) to lower pH to <2.	30

SCHEDULE CC - SAMPLING PRINCIPLES

Column 1	Column 2	Column 3	Column 4	Col. 5	Column 6	Column 7
ANALYTICAL TEST GROUP	LABORATORY SAMPLE CONTAINER	LABORATORY CONTAINER PRE-TREATMENT	TEST SPECIFIC SAMPLING PRECAUTIONS	MIN. SAM. VOL.	PRESERVATION METHOD	MAX. STORAGE TIME (DAYS)
Fluoride MC2	Sample containers and caps/ liners must be composed only of one or more of the following materials: fluorocarbon resin, polyethylene terephthalate, glass, polystyrene, polypropylene, high or low density polyethylene. Metallic foil should not be used.	Generally no pre-treatment required for new containers.	If sample is high (>5%) in hydrocarbons or organic solvents, use glass or fluorocarbon resin sample container only.	50 mL	None	28

SCHEDULE DD - ANALYTICAL PRINCIPLES & ANALYTICAL METHOD DETECTION LIMITS

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
ANALYTICAL TEST GROUP #	PARAMETERS CONVENTIONAL AND METAL PARAMETERS	SAMPLE PREPARATION METHOD PRINCIPLES	INSTRUMENTAL MEASUREMENT METHOD PRINCIPLES	ALTERNATE INSTRUMENTAL MEASUREMENT METHOD PRINCIPLES	ANALYTICAL METHOD DETECTION LIMITS
26	Abietic acid	pH adjusted to 9 Liquid/liquid extraction with methyl t-butyl ether methylation with diazomethane	Gas Chromatography/ Flame Ionization Detection Capillary column	N/A	0.005
	Chlorodehydroabietic acid				0.005
	Dehydroabietic acid				0.005
	Isopimaric acid				0.005
	Levopimaric acid				0.005
	Neoabietic acid				0.005
	Oleic acid				0.005
	Pimaric acid				0.005
MC1	Iron	Nitric evaporation or aqua regia digestion	Atomic absorption spectrometry and/or Emission Spectrometry - Inductively Coupled Plasma (ICP) or Direct Current Argon Plasma Spectrometry (DCP)	Polarography via the method of standard addition in the presence of suitable electrolyte	0.02 mg/L
	Magnesium				
MC2	Fluoride	Preparation for measurement system as appropriate	Colourimetry or Specific Ion Electrode	N/A	0.1 mg/L

		NAME OF EFFLUENT STREAM:	Storm Sewer
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	None
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None
		TOXICITY TESTS SAMPLING FREQUENCY:	None
		FREQUENCY OF SAMPLING:	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED	
3	Hydrogen ion (pH)	Hydrogen ion (pH)	X
5a	Organic carbon	Dissolved organic carbon (DOC)	X
5b	Organic carbon	Total organic carbon (TOC)	
8	Suspended solids	Total suspended solids (TSS)	X
		Volatile suspended solids (VSS)	
9	Total metals	Aluminum	X
		Beryllium	X
		Cadmium	X
		Chromium	X
		Cobalt	X
		Copper	X
		Lead	X
		Molybdenum	X
		Nickel	X
		Silver	X
		Thallium	X
		Vanadium	X
		Zinc	X
11	Chromium (Hexavalent) (NOTE 1)	Chromium (Hexavalent)	X
13	Total alkyl lead (NOTE 2)	Tetra-alkyl lead	X
		Tri-alkyl lead	X
25	Solvent Extractables	Oil and grease	X

SCHEDULE A: ACUSTAR CANADA INC. - ETOBICOKE

		NAME OF EFFLUENT STREAM:	Storm Sewer
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	None
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None
		TOXICITY TESTS SAMPLING FREQUENCY:	None
		FREQUENCY OF SAMPLING:	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED	
27	Polychlorinated Biphenyls (PCBs) (Total)	PCBs (Total)	X
MC1†	Metals	Iron	X
		Magnesium	X
MC2†	Fluoride	Fluoride	X

SCHEDULE B: The BOWMANVILLE FOUNDRY CO. LTD. - BOWMANVILLE

		NAME OF EFFLUENT STREAM:	Furnace Cooling System	
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water/Storm Water	
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	None	
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None	
		TOXICITY TESTS SAMPLING FREQUENCY:	None	
		FREQUENCY OF SAMPLING:	M	Q
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED		
3	Hydrogen ion (pH)	Hydrogen ion (pH)	X	
5a	Organic carbon	Dissolved organic carbon (DOC)	X	
5b		Total organic carbon (TOC)		
8	Suspended solids	Total suspended solids (TSS)	X	
		Volatile suspended solids (VSS)		
9	Total metals	Aluminum	X	
		Beryllium	X	
		Cadmium	X	
		Chromium	X	
		Cobalt	X	
		Copper	X	
		Lead	X	
		Molybdenum	X	
		Nickel	X	
		Silver	X	
		Thallium	X	
		Vanadium	X	
		Zinc	X	
11	Chromium (Hexavalent) (NOTE 1)	Chromium (Hexavalent)	X	
13	Total alkyl lead (NOTE 2)	Tetra-alkyl lead	X	
		Tri-alkyl lead	X	
14	Phenolics (4AAP)	Phenolics (4AAP)	X	

SCHEDULE B: The BOWMANVILLE FOUNDRY CO. LTD. - BOWMANVILLE

		NAME OF EFFLUENT STREAM:	Furnace Cooling System	
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water/Storm Water	
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	None	
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None	
		TOXICITY TESTS SAMPLING FREQUENCY:	None	
		FREQUENCY OF SAMPLING:	M	Q
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED		
25	Solvent Extractables	Oil and grease	X	
27	Polychlorinated Biphenyls (PCBs) (Total)	PCBs (Total)		X
MC1†	Metals	Iron	X	
		Magnesium	X	

SCHEDULE C: CANRON INC., PIPE DIVISION - HAMILTON

		NAME OF EFFLUENT STREAM:	Cupola Scrubber Sump Pit		South Storm Sewer		Cement Lining Sump Pit	
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water/ Storm Water		Storm Water		Cooling Water	
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/BB		None		None	
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None		None		None	
		TOXICITY TESTS SAMPLING FREQUENCY:	Q		None		None	
		FREQUENCY OF SAMPLING:	M	Q	M	Q	M	Q
ANALYTICAL TEST GROUP		**PARAMETERS TO BE ANALYZED**						
3	Hydrogen ion (pH)	Hydrogen ion (pH)	X		X		X	
5a	Organic carbon	Dissolved organic carbon (DOC)	X		X		X	
5b		Total organic carbon (TOC)						
8	Suspended solids	Total suspended solids (TSS)	X		X		X	
		Volatile suspended solids (VSS)						
9	Total metals	Aluminum	X		X		X	
		Beryllium	X		X		X	
		Cadmium	X		X		X	
		Chromium	X		X		X	
		Cobalt	X		X		X	
		Copper	X		X		X	
		Lead	X		X		X	
		Molybdenum	X		X		X	
		Nickel	X		X		X	
		Silver	X		X		X	
		Thallium	X		X		X	
		Vanadium	X		X		X	
		Zinc	X		X		X	
11	Chromium (Hexavalent) (NOTE 1)	Chromium (Hexavalent)	X		X		X	
13	Total alkyl lead (NOTE 2)	Tetra-alkyl lead	X		X		X	
		Tri-alkyl lead	X		X		X	

SCHEDULE C: CANRON INC., PIPE DIVISION - HAMILTON

		NAME OF EFFLUENT STREAM:	Cupola Scrubber Sump Pit		South Storm Sewer		Cement Lining Sump Pit	
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water/ Storm Water		Storm Water		Cooling Water	
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/BB		None		None	
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None		None		None	
		TOXICITY TESTS SAMPLING FREQUENCY:	Q		None		None	
		FREQUENCY OF SAMPLING:	M	Q	M	Q	M	Q
ANALYTICAL TEST GROUP		**PARAMETERS TO BE ANALYZED**						
14	Phenolics (4AAP)	Phenolics (4AAP)	X		X		X	
25	Solvent Extractables	Oil and grease	X		X		X	
27	Polychlorinated Biphenyls (PCBs) (Total)	PCBs (Total)				X		X
MC1†	Metals	Iron	X		X		X	
		Magnesium	X		X		X	
MC2†	Fluoride	Fluoride	X					

SCHEDULE C: CANRON INC., PIPE DIVISION - HAMILTON

		NAME OF EFFLUENT STREAM:	Main Floor Drain Sump Pit		Accubar	
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water		Cooling Water	
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	None		None	
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None		None	
		TOXICITY TESTS SAMPLING FREQUENCY:	None		None	
		FREQUENCY OF SAMPLING:	M	Q	M	Q
ANALYTICAL TEST GROUP		**PARAMETERS TO BE ANALYZED**				
3	Hydrogen ion (pH)	Hydrogen ion (pH)	X		X	
5a	Organic carbon	Dissolved organic carbon (DOC)	X		X	
5b		Total organic carbon (TOC)				
8	Suspended solids	Total suspended solids (TSS)	X		X	
		Volatile suspended solids (VSS)				
9	Total metals	Aluminum	X		X	
		Beryllium	X		X	
		Cadmium	X		X	
		Chromium	X		X	
		Cobalt	X		X	
		Copper	X		X	
		Lead	X		X	
		Molybdenum	X		X	
		Nickel	X		X	
		Silver	X		X	
		Thallium	X		X	
		Vanadium	X		X	
		Zinc	X		X	
11	Chromium (Hexavalent) (NOTE 1)	Chromium (Hexavalent)	X		X	
13	Total alkyl lead (NOTE 2)	Tetra-alkyl lead	X		X	
		Tri-alkyl lead	X		X	

SCHEDULE C: CANRON INC., PIPE DIVISION - HAMILTON

		NAME OF EFFLUENT STREAM:	Main Floor Drain Sump Pit		Accubar	
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water		Cooling Water	
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	None		None	
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None		None	
		TOXICITY TESTS SAMPLING FREQUENCY:	None		None	
		FREQUENCY OF SAMPLING:	M	Q	M	Q
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED				
14	Phenolics (4AAP)	Phenolics (4AAP)	X			
25	Solvent Extractables	Oil and grease	X		X	
27	Polychlorinated Biphenyls (PCBs) (Total)	PCBs (Total)		X		
MC1†	Metals	Iron	X		X	
		Magnesium	X		X	
MC2†	Fluoride	Fluoride				

SCHEDULE D: FAHRAMET STEEL CASTINGS - ORILLIA

		NAME OF EFFLUENT STREAM:	Cooling Pond Overflow
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water/ Storm Water
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/BB
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None
		TOXICITY TESTS SAMPLING FREQUENCY:	Q
		FREQUENCY OF SAMPLING:	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED	
3	Hydrogen ion (pH)	Hydrogen ion (pH)	X
5a	Organic carbon	Dissolved organic carbon (DOC)	X
5b		Total organic carbon (TOC)	
8	Suspended solids	Total suspended solids (TSS)	X
		Volatile suspended solids (VSS)	
9	Total metals	Aluminum	X
		Beryllium	X
		Cadmium	X
		Chromium	X
		Cobalt	X
		Copper	X
		Lead	X
		Molybdenum	X
		Nickel	X
		Silver	X
		Thallium	X
		Vanadium	X
		Zinc	X
11	Chromium (Hexavalent) (NOTE 1)	Chromium (Hexavalent)	X
13	Total alkyl lead (NOTE 2)	Tetra-alkyl lead	X
		Tri-alkyl lead	X

SCHEDULE D: FAHRAMET STEEL CASTINGS - ORILLIA

		NAME OF EFFLUENT STREAM:	Cooling Pond Overflow
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water/ Storm Water
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/BB
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None
		TOXICITY TESTS SAMPLING FREQUENCY:	Q
		FREQUENCY OF SAMPLING:	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED	
14	Phenolics (4AAP)	Phenolics (4AAP)	X
25	Solvent Extractables	Oil and grease	X
MC1†	Metals	Iron	X
		Magnesium	X
MC2†	Fluoride	Fluoride	X

SCHEDULE E: FORD MOTOR COMPANY OF CANADA LTD. - WINDSOR

		NAME OF EFFLUENT STREAM:	Foundry Process				Combined			
		EFFLUENT STREAM CLASSIFICATION:	Process				Combined			
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/AA				Q/AA			
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	Q				Q			
		TOXICITY TESTS SAMPLING FREQUENCY:	None				M			
		FREQUENCY OF SAMPLING:	D	TW	W	M	D	TW	W	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED								
1	Chemical Oxygen Demand	Chemical oxygen demand (COD)		X				X		
2	Total cyanide	Total cyanide				X				X
3	Hydrogen ion (pH)	Hydrogen ion (pH)	X				X			
4a	Nitrogen	Ammonia plus Ammonium				X				X
		Total Kjeldahl nitrogen								
4b	Nitrogen	Nitrate + Nitrite				X				X
5a	Organic carbon	Dissolved organic carbon (DOC)			X				X	
5b	Organic carbon	Total organic carbon (TOC)								
6	Total phosphorus	Total phosphorus			X				X	
7	Specific conductance	Specific conductance	X				X			
8	Suspended solids	Total suspended solids (TSS)	X				X			
		Volatile suspended solids (VSS)								
9	Total metals	Aluminum		X				X		
		Beryllium		X				X		
		Cadmium		X				X		
		Chromium		X				X		
		Cobalt		X				X		
		Copper		X				X		
		Lead		X				X		

SCHEDULE E: FORD MOTOR COMPANY OF CANADA LTD. - WINDSOR

		NAME OF EFFLUENT STREAM:	Foundry Process				Combined			
		EFFLUENT STREAM CLASSIFICATION:	Process				Combined			
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/AA				Q/AA			
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	Q				Q			
		TOXICITY TESTS SAMPLING FREQUENCY:	None				M			
		FREQUENCY OF SAMPLING:	D	TW	W	M	D	TW	W	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED								
9	Total metals (continued)	Molybdenum		X				X		
		Nickel		X				X		
		Silver		X				X		
		Thallium		X				X		
		Vanadium		X				X		
		Zinc		X				X		
11	Chromium (Hexavalent) (NOTE 1)	Chromium (Hexavalent)		X				X		
12	Mercury	Mercury				X				X
13	Total alkyl lead (NOTE 2)	Tetra-alkyl lead				X				X
		Tri-alkyl lead				X				X
14	Phenolics (4AAP)	Phenolics (4AAP)	X				X			
15	Sulphide	Sulphide				X				X
16	Volatiles, Halogenated	1,1,2,2-Tetrachloroethane				X				X
		1,1,2-Trichloroethane				X				X
		1,1-Dichloroethane				X				X
		1,1-Dichloroethylene				X				X
		1,2-Dichlorobenzene				X				X
		1,2-Dichloroethane (Ethylene dichloride)				X				X
		1,2-Dichloropropane				X				X
		1,3-Dichlorobenzene				X				X
		1,4-Dichlorobenzene				X				X
		Bromoform				X				X
		Bromomethane				X				X

SCHEDULE E: FORD MOTOR COMPANY OF CANADA LTD. - WINDSOR

		NAME OF EFFLUENT STREAM:	Foundry Process				Combined			
		EFFLUENT STREAM CLASSIFICATION:	Process				Combined			
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/AA				Q/AA			
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	Q				Q			
		TOXICITY TESTS SAMPLING FREQUENCY:	None				M			
		FREQUENCY OF SAMPLING:	D	TW	W	M	D	TW	W	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED								
16	Volatiles, Halogenated (continued)	Carbon tetrachloride				X				X
		Chlorobenzene				X				X
		Chloroform				X				X
		Chloromethane				X				X
		Cis-1,3-Dichloropropylene				X				X
		Dibromochloromethane				X				X
		Ethylene dibromide				X				X
		Methylene chloride				X				X
		Tetrachloroethylene (Perchloroethylene)				X				X
		Trans-1,2-Dichloroethylene				X				X
		Trans-1,3-Dichloropropylene				X				X
		Trichloroethylene				X				X
		Trichlorofluoromethane				X				X
		Vinyl chloride (Chloroethylene)				X				X
17	Volatiles, Non-Halogenated	Benzene				X				X
		Styrene				X				X
		Toluene				X				X
		o-Xylene				X				X
		m-Xylene and p-Xylene				X				X
18	Volatiles, Water Soluble	Acrolein				X				X
		Acrylonitrile				X				X

SCHEDULE E: FORD MOTOR COMPANY OF CANADA LTD. - WINDSOR

		NAME OF EFFLUENT STREAM:	Foundry Process				Combined			
		EFFLUENT STREAM CLASSIFICATION:	Process				Combined			
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/AA				Q/AA			
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	Q				Q			
		TOXICITY TESTS SAMPLING FREQUENCY:	None				M			
		FREQUENCY OF SAMPLING:	D	TW	W	M	D	TW	W	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED								
19	Extractables, Base Neutral	Acenaphthene				X				X
		5-nitro Acenaphthene				X				X
		Acenaphthylene				X				X
		Anthracene				X				X
		Benz(a)anthracene				X				X
		Benzo(a)pyrene				X				X
		Benzo(b)fluoranthene				X				X
		Benzo(g,h,i)perylene				X				X
		Benzo(k)fluoranthene				X				X
		Biphenyl				X				X
		Camphene				X				X
		1-Chloronaphthalene				X				X
		2-Chloronaphthalene				X				X
		Chrysene				X				X
		Dibenz(a,h)anthracene				X				X
		Fluoranthene				X				X
		Fluorene				X				X
		Indeno(1,2,3-cd)pyrene				X				X
		Indole				X				X
		1-Methylnaphthalene				X				X
		2-Methylnaphthalene				X				X
		Naphthalene			X					X
		Perylene				X				X
		Phenanthrene			X					X
		Pyrene				X				X
		Benzylbutylphthalate				X				X
		Bis(2-Ethylhexyl)phthalate				X				X
		Di-n-butylphthalate				X				X
		4-Bromophenyl phenyl ether				X				X

		NAME OF EFFLUENT STREAM:	Foundry Process				Combined			
		EFFLUENT STREAM CLASSIFICATION:	Process				Combined			
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/AA				Q/AA			
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	Q				Q			
		TOXICITY TESTS SAMPLING FREQUENCY:	None				M			
		FREQUENCY OF SAMPLING:	D	TW	W	M	D	TW	W	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED								
19	Extractables, Base Neutral (continued)	4-Chlorophenyl phenyl ether				X				X
		Bis(2-Chloroisopropyl)ether				X				X
		Bis(2-Chloroethyl)ether				X				X
		Diphenyl ether				X				X
		2,4-Dinitrotoluene				X				X
		2,6-Dinitrotoluene				X				X
		Bis(2-Chloroethoxy)methane				X				X
		Diphenylamine				X				X
		N-Nitrosodiphenylamine				X				X
		N-Nitrosodi-n-propylamine				X				X
20	Extractables, Acid (Phenolics)	2,3,4,5-Tetrachlorophenol				X				X
		2,3,4,6-Tetrachlorophenol				X				X
		2,3,5,6-Tetrachlorophenol				X				X
		2,3,4-Trichlorophenol				X				X
		2,3,5-Trichlorophenol				X				X
		2,4,5-Trichlorophenol				X				X
		2,4,6-Trichlorophenol				X				X
		2,4-Dimethylphenol				X				X
		2,4-Dinitrophenol				X				X
		2,4-Dichlorophenol				X				X
		2,6-Dichlorophenol				X				X
		4,6-Dinitro-o-cresol				X				X
		2-Chlorophenol				X				X
		4-Chloro-3-methylphenol				X				X
		4-Nitrophenol				X				X

SCHEDULE E: FORD MOTOR COMPANY OF CANADA LTD. - WINDSOR

		NAME OF EFFLUENT STREAM:	Foundry Process				Combined			
		EFFLUENT STREAM CLASSIFICATION:	Process				Combined			
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/AA				Q/AA			
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	Q				Q			
		TOXICITY TESTS SAMPLING FREQUENCY:	None				M			
		FREQUENCY OF SAMPLING:	D	TW	W	M	D	TW	W	M
ANALYTICAL TEST GROUP		**PARAMETERS TO BE ANALYZED**								
20	Extractables, Acid (Phenolics) (continued)	m-Cresol				X				X
		o-Cresol				X				X
		p-Cresol				X				X
		Pentachlorophenol				X				X
		Phenol				X				X
25	Solvent Extractables	Oil and grease		X				X		
26†	Fatty and Resin Acids					X				X
27	Polychlorinated Biphenyls (PCBs) (Total)	PCBs (Total)				X				X
MC1†	Metals	Iron		X				X		
		Magnesium		X				X		
MC2†	Fluoride	Fluoride		X				X		

SCHEDULE F: FRANKLIN ELECTRIC OF CANADA LTD. - STRATHROY

		NAME OF EFFLUENT STREAM:	Cooling Pond Overflow
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water/Storm Water
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/BB
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None
		TOXICITY TESTS SAMPLING FREQUENCY:	Q
		FREQUENCY OF SAMPLING:	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED	
3	Hydrogen ion (pH)	Hydrogen ion (pH)	X
5a	Organic carbon	Dissolved organic carbon (DOC)	X
5b		Total organic carbon (TOC)	
8	Suspended solids	Total suspended solids (TSS)	X
		Volatile suspended solids (VSS)	
9	Total metals	Aluminum	X
		Beryllium	X
		Cadmium	X
		Chromium	X
		Cobalt	X
		Copper	X
		Lead	X
		Molybdenum	X
		Nickel	X
		Silver	X
		Thallium	X
		Vanadium	X
		Zinc	X
11	Chromium (Hexavalent) (NOTE 1)	Chromium (Hexavalent)	X
13	Total alkyl lead (NOTE 2)	Tetra-alkyl lead	X
		Tri-alkyl lead	X

SCHEDULE F: FRANKLIN ELECTRIC OF CANADA LTD. - STRATHROY

		NAME OF EFFLUENT STREAM:	Cooling Pond Overflow
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water/Storm Water
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/BB
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None
		TOXICITY TESTS SAMPLING FREQUENCY:	Q
		FREQUENCY OF SAMPLING:	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED	
25	Solvent Extractables	Oil and grease	X
MC1†	Metals	Iron	X
		Magnesium	X

SCHEDULE G: GENERAL MOTORS OF CANADA LTD. - ST. CATHARINES

		NAME OF EFFLUENT STREAM:	Foundry Process				Combined		
		EFFLUENT STREAM CLASSIFICATION:	Process				Combined		
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/AA				Q/BB		
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	Q				SA		
		TOXICITY TESTS SAMPLING FREQUENCY:	None				M		
		FREQUENCY OF SAMPLING:	D	TW	W	M	TW	W	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED							
1	Chemical Oxygen Demand	Chemical oxygen demand (COD)		X				X	
2	Total cyanide	Total cyanide				X			X
3	Hydrogen ion (pH)	Hydrogen ion (pH)	X				X		
4a	Nitrogen	Ammonia plus Ammonium				X			X
		Total Kjeldahl nitrogen							
4b	Nitrogen	Nitrate + Nitrite				X			
5a	Organic carbon	Dissolved organic carbon (DOC)			X			X	
5b	Organic carbon	Total organic carbon (TOC)							
6	Total phosphorus	Total phosphorus			X			X	
7	Specific conductance	Specific conductance	X						
8	Suspended solids	Total suspended solids (TSS)	X				X		
		Volatile suspended solids (VSS)							
9	Total metals	Aluminum		X				X	
		Beryllium		X				X	
		Cadmium		X				X	
		Chromium		X				X	
		Cobalt		X				X	
		Copper		X				X	
		Lead		X				X	

SCHEDULE G: GENERAL MOTORS OF CANADA LTD. - ST. CATHARINES

		NAME OF EFFLUENT STREAM:	Foundry Process				Combined		
		EFFLUENT STREAM CLASSIFICATION:	Process				Combined		
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/AA				Q/BB		
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	Q				SA		
		TOXICITY TESTS SAMPLING FREQUENCY:	None				M		
		FREQUENCY OF SAMPLING:	D	TW	W	M	TW	W	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED							
9	Total metals (continued)	Molybdenum		X				X	
		Nickel		X				X	
		Silver		X				X	
		Thallium		X				X	
		Vanadium		X				X	
		Zinc		X				X	
11	Chromium (Hexavalent) (NOTE 1)	Chromium (Hexavalent)		X				X	
12	Mercury	Mercury				X			
13	Total alkyl lead (NOTE 2)	Tetra-alkyl lead				X			X
		Tri-alkyl lead				X			X
14	Phenolics (4AAP)	Phenolics (4AAP)	X				X		
15	Sulphide	Sulphide				X			
16	Volatiles, Halogenated	1,1,2,2-Tetrachloroethane				X			
		1,1,2-Trichloroethane				X			
		1,1-Dichloroethane				X			
		1,1-Dichloroethylene				X			
		1,2-Dichlorobenzene				X			
		1,2-Dichloroethane (Ethylene dichloride)				X			
		1,2-Dichloropropane				X			
		1,3-Dichlorobenzene				X			
		1,4-Dichlorobenzene				X			
		Bromoform				X			
		Bromomethane				X			

		NAME OF EFFLUENT STREAM:	Foundry Process				Combined		
		EFFLUENT STREAM CLASSIFICATION:	Process				Combined		
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/AA				Q/BB		
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	Q				SA		
		TOXICITY TESTS SAMPLING FREQUENCY:	None				M		
		FREQUENCY OF SAMPLING:	D	TW	W	M	TW	W	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED							
16	Volatiles, Halogenated (continued)	Carbon tetrachloride				X			
		Chlorobenzene				X			
		Chloroform				X			
		Chloromethane				X			
		Cis-1,3-Dichloropropylene				X			
		Dibromochloromethane				X			
		Ethylene dibromide				X			
		Methylene chloride				X			
		Tetrachloroethylene (Perchloroethylene)				X			
		Trans-1,2-Dichloroethylene				X			
		Trans-1,3-Dichloropropylene				X			
		Trichloroethylene				X			
		Trichlorofluoromethane				X			
		Vinyl chloride (Chloroethylene)				X			
17	Volatiles, Non-Halogenated	Benzene				X			
		Styrene				X			
		Toluene				X			
		o-Xylene				X			
		m-Xylene and p-Xylene				X			
18	Volatiles, Water Soluble	Acrolein				X			
		Acrylonitrile				X			

SCHEDULE G: GENERAL MOTORS OF CANADA LTD. - ST. CATHARINES

			Foundry Process				Combined		
NAME OF EFFLUENT STREAM:			Foundry Process				Combined		
EFFLUENT STREAM CLASSIFICATION:			Process				Combined		
CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:			Q/AA				Q/BB		
OPEN CHARACTERIZATION SAMPLING FREQUENCY:			Q				SA		
TOXICITY TESTS SAMPLING FREQUENCY:			None				M		
FREQUENCY OF SAMPLING:			D	TW	W	M	TW	W	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED							
19	Extractables, Base Neutral	Acenaphthene				X			
		5-nitro Acenaphthene				X			
		Acenaphthylene				X			
		Anthracene				X			
		Benz(a)anthracene				X			
		Benzo(a)pyrene				X			
		Benzo(b)fluoranthene				X			
		Benzo(g,h,i)perylene				X			
		Benzo(k)fluoranthene				X			
		Biphenyl				X			
		Camphene				X			
		1-Chloronaphthalene				X			
		2-Chloronaphthalene				X			
		Chrysene				X			
		Dibenz(a,h)anthracene				X			
		Fluoranthene				X			
		Fluorene				X			
		Indeno(1,2,3-cd)pyrene				X			
		Indole				X			
		1-Methylnaphthalene				X			
		2-Methylnaphthalene				X			
		Naphthalene			X				
		Perylene				X			
		Phenanthrene			X				
		Pyrene				X			
		Benzylbutylphthalate				X			
		Bis(2-Ethylhexyl)phthalate				X			
		Di-n-butylphthalate				X			
		4-Bromophenyl phenyl ether				X			

		NAME OF EFFLUENT STREAM:	Foundry Process				Combined		
		EFFLUENT STREAM CLASSIFICATION:	Process				Combined		
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/AA				Q/BB		
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	Q				SA		
		TOXICITY TESTS SAMPLING FREQUENCY:	None				M		
		FREQUENCY OF SAMPLING:	D	TW	W	M	TW	W	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED							
19	Extractables, Base Neutral (continued)	4-Chlorophenyl phenyl ether				X			
		Bis(2-Chloroisopropyl)ether				X			
		Bis(2-Chloroethyl)ether				X			
		Diphenyl ether				X			
		2,4-Dinitrotoluene				X			
		2,6-Dinitrotoluene				X			
		Bis(2-Chloroethoxy)methane				X			
		Diphenylamine				X			
		N-Nitrosodiphenylamine				X			
		N-Nitrosodi-n-propylamine				X			
20	Extractables, Acid (Phenolics)	2,3,4,5-Tetrachlorophenol				X			
		2,3,4,6-Tetrachlorophenol				X			
		2,3,5,6-Tetrachlorophenol				X			
		2,3,4-Trichlorophenol				X			
		2,3,5-Trichlorophenol				X			
		2,4,5-Trichlorophenol				X			
		2,4,6-Trichlorophenol				X			
		2,4-Dimethylphenol				X			
		2,4-Dinitrophenol				X			
		2,4-Dichlorophenol				X			
		2,6-Dichlorophenol				X			
		4,6-Dinitro-o-cresol				X			
		2-Chlorophenol				X			
		4-Chloro-3-methylphenol				X			
		4-Nitrophenol				X			

		NAME OF EFFLUENT STREAM:	Foundry Process				Combined		
		EFFLUENT STREAM CLASSIFICATION:	Process				Combined		
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/AA				Q/BB		
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	Q				SA		
		TOXICITY TESTS SAMPLING FREQUENCY:	None				M		
		FREQUENCY OF SAMPLING:	D	TW	W	M	TW	W	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED							
20	Extractables, Acid (Phenolics) (continued)	m-Cresol				X			
		o-Cresol				X			
		p-Cresol				X			
		Pentachlorophenol				X			
		Phenol				X			
25	Solvent Extractables	Oil and grease		X			X		
26†	Fatty and Resin Acids					X			
27	Polychlorinated Biphenyls (PCBs) (Total)	PCBs (Total)				X			X
MC1†	Metals	Iron		X				X	
		Magnesium		X				X	
MC2†	Fluoride	Fluoride				X			

		NAME OF EFFLUENT STREAM:	NE Process Sewer				SE Process Sewer			
		EFFLUENT STREAM CLASSIFICATION:	Process				Process			
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/AA				Q/AA			
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	Q				Q			
		TOXICITY TESTS SAMPLING FREQUENCY:	M				M			
		FREQUENCY OF SAMPLING:	D	TW	W	M	D	TW	W	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED								
1	Chemical Oxygen Demand	Chemical oxygen demand (COD)		X				X		
2	Total cyanide	Total cyanide				X				X
3	Hydrogen ion (pH)	Hydrogen ion (pH)	X				X			
4a	Nitrogen	Ammonia plus Ammonium		X				X		
		Total Kjeldahl nitrogen								
4b	Nitrogen	Nitrate + Nitrite			X					X
5a	Organic carbon	Dissolved organic carbon (DOC)			X				X	
5b	Organic carbon	Total organic carbon (TOC)								
6	Total phosphorus	Total phosphorus			X				X	
7	Specific conductance	Specific conductance	X				X			
8	Suspended solids	Total suspended solids (TSS)	X				X			
		Volatile suspended solids (VSS)								
9	Total metals	Aluminum		X				X		
		Beryllium		X				X		
		Cadmium		X				X		
		Chromium		X				X		
		Cobalt		X				X		
		Copper		X				X		
		Lead		X				X		

		NAME OF EFFLUENT STREAM:	NE Process Sewer				SE Process Sewer			
		EFFLUENT STREAM CLASSIFICATION:	Process				Process			
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/AA				Q/AA			
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	Q				Q			
		TOXICITY TESTS SAMPLING FREQUENCY:	M				M			
		FREQUENCY OF SAMPLING:	D	TW	W	M	D	TW	W	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED								
9	Total metals (continued)	Molybdenum		X				X		
		Nickel		X				X		
		Silver		X				X		
		Thallium		X				X		
		Vanadium		X				X		
		Zinc		X				X		
11	Chromium (Hexavalent) (NOTE 1)	Chromium (Hexavalent)		X				X		
12	Mercury	Mercury				X				X
13	Total alkyl lead (NOTE 2)	Tetra-alkyl lead				X				X
		Tri-alkyl lead				X				X
14	Phenolics (4AAP)	Phenolics (4AAP)	X				X			
15	Sulphide	Sulphide				X				X
16	Volatiles, Halogenated	1,1,2,2-Tetrachloroethane				X				X
		1,1,2-Trichloroethane				X				X
		1,1-Dichloroethane				X				X
		1,1-Dichloroethylene				X				X
		1,2-Dichlorobenzene				X				X
		1,2-Dichloroethane (Ethylene dichloride)				X				X
		1,2-Dichloropropane				X				X
		1,3-Dichlorobenzene				X				X
		1,4-Dichlorobenzene				X				X
		Bromoform				X				X
		Bromomethane				X				X

		NAME OF EFFLUENT STREAM:	NE Process Sewer				SE Process Sewer			
		EFFLUENT STREAM CLASSIFICATION:	Process				Process			
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/AA				Q/AA			
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	Q				Q			
		TOXICITY TESTS SAMPLING FREQUENCY:	M				M			
		FREQUENCY OF SAMPLING:	D	TW	W	M	D	TW	W	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED								
16	Volatiles, Halogenated (continued)	Carbon tetrachloride				X				X
		Chlorobenzene				X				X
		Chloroform				X				X
		Chloromethane				X				X
		Cis-1,3-Dichloropropylene				X				X
		Dibromochloromethane				X				X
		Ethylene dibromide				X				X
		Methylene chloride				X				X
		Tetrachloroethylene (Perchloroethylene)				X				X
		Trans-1,2-Dichloroethylene				X				X
		Trans-1,3-Dichloropropylene				X				X
		Trichloroethylene				X				X
		Trichlorofluoromethane				X				X
		Vinyl chloride (Chloroethylene)				X				X
17	Volatiles, Non-Halogenated	Benzene				X				X
		Styrene				X				X
		Toluene				X				X
		o-Xylene				X				X
		m-Xylene and p-Xylene				X				X

SCHEDULE H: HALEY INDUSTRIES LTD. - HALEY

		NAME OF EFFLUENT STREAM:	NE Process Sewer				SE Process Sewer			
		EFFLUENT STREAM CLASSIFICATION:	Process				Process			
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/AA				Q/AA			
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	Q				Q			
		TOXICITY TESTS SAMPLING FREQUENCY:	M				M			
		FREQUENCY OF SAMPLING:	D	TW	W	M	D	TW	W	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED								
19	Extractables, Base Neutral	Acenaphthene				X				X
		5-nitro Acenaphthene				X				X
		Acenaphthylene				X				X
		Anthracene				X				X
		Benz(a)anthracene				X				X
		Benzo(a)pyrene				X				X
		Benzo(b)fluoranthene				X				X
		Benzo(g,h,i)perylene				X				X
		Benzo(k)fluoranthene				X				X
		Biphenyl				X				X
		Camphene				X				X
		1-Chloronaphthalene				X				X
		2-Chloronaphthalene				X				X
		Chrysene				X				X
		Dibenz(a,h)anthracene				X				X
		Fluoranthene				X				X
		Fluorene				X				X
		Indeno(1,2,3-cd)pyrene				X				X
		Indole				X				X
		1-Methylnaphthalene				X				X
		2-Methylnaphthalene				X				X
		Naphthalene				X				X
		Perylene				X				X
		Phenanthrene				X				X
		Pyrene				X				X
		Benzylbutylphthalate				X				X
		Bis(2-Ethylhexyl)phthalate				X				X
		Di-n-butylphthalate				X				X
		4-Bromophenyl phenyl ether				X				X

		NAME OF EFFLUENT STREAM:	NE Process Sewer				SE Process Sewer			
		EFFLUENT STREAM CLASSIFICATION:	Process				Process			
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/AA				Q/AA			
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	Q				Q			
		TOXICITY TESTS SAMPLING FREQUENCY:	M				M			
		FREQUENCY OF SAMPLING:	D	TW	W	M	D	TW	W	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED								
19	Extractables, Base Neutral (continued)	4-Chlorophenyl phenyl ether				X				X
		Bis(2-Chloroisopropyl)ether				X				X
		Bis(2-Chloroethyl)ether				X				X
		Diphenyl ether				X				X
		2,4-Dinitrotoluene				X				X
		2,6-Dinitrotoluene				X				X
		Bis(2-Chloroethoxy)methane				X				X
		Diphenylamine				X				X
		N-Nitrosodiphenylamine				X				X
		N-Nitrosodi-n-propylamine				X				X
20	Extractables, Acid (Phenolics)	2,3,4,5-Tetrachlorophenol				X				X
		2,3,4,6-Tetrachlorophenol				X				X
		2,3,5,6-Tetrachlorophenol				X				X
		2,3,4-Trichlorophenol				X				X
		2,3,5-Trichlorophenol				X				X
		2,4,5-Trichlorophenol				X				X
		2,4,6-Trichlorophenol				X				X
		2,4-Dimethylphenol				X				X
		2,4-Dinitrophenol				X				X
		2,4-Dichlorophenol				X				X
		2,6-Dichlorophenol				X				X
		4,6-Dinitro-o-cresol				X				X
		2-Chlorophenol				X				X
		4-Chloro-3-methylphenol				X				X
		4-Nitrophenol				X				X

SCHEDULE H: HALEY INDUSTRIES LTD. - HALEY

		NAME OF EFFLUENT STREAM:	NE Process Sewer				SE Process Sewer			
		EFFLUENT STREAM CLASSIFICATION:	Process				Process			
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	Q/AA				Q/AA			
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	Q				Q			
		TOXICITY TESTS SAMPLING FREQUENCY:	M				M			
		FREQUENCY OF SAMPLING:	D	TW	W	M	D	TW	W	M
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED								
20	Extractables, Acid (Phenolics) (continued)	m-Cresol				X				X
		o-Cresol				X				X
		p-Cresol				X				X
		Pentachlorophenol				X				X
		Phenol				X				X
25	Solvent Extractables	Oil and grease		X				X		
26†	Fatty and Resin Acids					X				X
27	Polychlorinated Biphenyls (PCBs) (Total)	PCBs (Total)				X				X
MC1†	Metals	Iron		X				X		
		Magnesium		X				X		
MC2†	Fluoride	Fluoride		X				X		

SCHEDULE I: MAGALLOY LTD. - STRATFORD

		NAME OF EFFLUENT STREAM:	Cooling Tank	
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water	
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	None	
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None	
		TOXICITY TESTS SAMPLING FREQUENCY:	None	
		FREQUENCY OF SAMPLING:	M	Q
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED		
3	Hydrogen ion (pH)	Hydrogen ion (pH)	X	
5a	Organic carbon	Dissolved organic carbon (DOC)	X	
5b		Total organic carbon (TOC)		
8	Suspended solids	Total suspended solids (TSS)	X	
		Volatile suspended solids (VSS)		
9	Total metals	Aluminum	X	
		Beryllium	X	
		Cadmium	X	
		Chromium	X	
		Cobalt	X	
		Copper	X	
		Lead	X	
		Molybdenum	X	
		Nickel	X	
		Silver	X	
		Thallium	X	
		Vanadium	X	
		Zinc	X	
11	Chromium (Hexavalent) (NOTE 1)	Chromium (Hexavalent)	X	
13	Total alkyl lead (NOTE 2)	Tetra-alkyl lead	X	
		Tri-alkyl lead	X	
14	Phenolics (4AAP)	Phenolics (4AAP)	X	

SCHEDULE I: MAGALLOY LTD. - STRATFORD

		NAME OF EFFLUENT STREAM:	Cooling Tank	
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water	
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	None	
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None	
		TOXICITY TESTS SAMPLING FREQUENCY:	None	
		FREQUENCY OF SAMPLING:	M	Q
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED		
25	Solvent Extractables	Oil and grease	X	
27	Polychlorinated Biphenyls (PCBs) (Total) (NOTE 4)	PCBs (Total)		X
MC1†	Metals	Iron	X	
		Magnesium	X	

		NAME OF EFFLUENT STREAM:	12 Inch Outlet Sewer	
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water/ Storm Water	
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	None	
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None	
		TOXICITY TESTS SAMPLING FREQUENCY:	None	
		FREQUENCY OF SAMPLING:	M	Q
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED		
3	Hydrogen ion (pH)	Hydrogen ion (pH)	X	
5a	Organic carbon	Dissolved organic carbon (DOC)	X	
5b		Total organic carbon (TOC)		
8	Suspended solids	Total suspended solids (TSS)	X	
		Volatile suspended solids (VSS)		
9	Total metals	Aluminum	X	
		Beryllium	X	
		Cadmium	X	
		Chromium	X	
		Cobalt	X	
		Copper	X	
		Lead	X	
		Molybdenum	X	
		Nickel	X	
		Silver	X	
		Thallium	X	
		Vanadium	X	
		Zinc	X	
11	Chromium (Hexavalent) (NOTE 1)	Chromium (Hexavalent)	X	
13	Total alkyl lead (NOTE 2)	Tetra-alkyl lead	X	
		Tri-alkyl lead	X	

SCHEDULE J: RICHMOND DIE CASTING LTD. - CORNWALL

		NAME OF EFFLUENT STREAM:	12 Inch Outlet Sewer	
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water/ Storm Water	
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	None	
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None	
		TOXICITY TESTS SAMPLING FREQUENCY:	None	
		FREQUENCY OF SAMPLING:	M	Q
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED		
25	Solvent Extractables	Oil and grease	X	
27	Polychlorinated Biphenyls (PCBs) (Total)	PCBs (Total)		X
MC1†	Metals	Iron	X	
		Magnesium	X	
MC2†	Fluoride	Fluoride	X	

SCHEDULE K: A. H. TALLMAN BRONZE COMPANY LTD. - BURLINGTON

		NAME OF EFFLUENT STREAM:	Compressor Cooling Water		Casting Machine Cooling Water	
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water		Cooling Water	
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	None		None	
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None		None	
		TOXICITY TESTS SAMPLING FREQUENCY:	None		None	
		FREQUENCY OF SAMPLING:	M	Q	M	Q
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED				
3	Hydrogen ion (pH)	Hydrogen ion (pH)	X		X	
5a	Organic carbon	Dissolved organic carbon (DOC)	X		X	
5b		Total organic carbon (TOC)				
8	Suspended solids	Total suspended solids (TSS)	X		X	
		Volatile suspended solids (VSS)				
9	Total metals	Aluminum	X		X	
		Beryllium	X		X	
		Cadmium	X		X	
		Chromium	X		X	
		Cobalt	X		X	
		Copper	X		X	
		Lead	X		X	
		Molybdenum	X		X	
		Nickel	X		X	
		Silver	X		X	
		Thallium	X		X	
		Vanadium	X		X	
		Zinc	X		X	
11	Chromium (Hexavalent) (NOTE 1)	Chromium (Hexavalent)	X		X	
13	Total alkyl lead (NOTE 2)	Tetra-alkyl lead	X		X	
		Tri-alkyl lead	X		X	

SCHEDULE K: A. H. TALLMAN BRONZE COMPANY LTD. - BURLINGTON

		NAME OF EFFLUENT STREAM:	Compressor Cooling Water		Casting Machine Cooling Water	
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water		Cooling Water	
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	None		None	
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None		None	
		TOXICITY TESTS SAMPLING FREQUENCY:	None		None	
		FREQUENCY OF SAMPLING:	M	Q	M	Q
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED				
14	Phenolics (4AAP)	Phenolics (4AAP)			X	
25	Solvent Extractables	Oil and grease	X		X	
27	Polychlorinated Biphenyls (PCBs) (Total) (NOTE 6)	PCBs (Total)		X		X
MC1†	Metals	Iron	X		X	
		Magnesium	X		X	

SCHEDULE L: WESTERN FOUNDRY COMPANY LTD. - WINGHAM

		NAME OF EFFLUENT STREAM:	Furnace Cooling Water Sewer		Core Machine/Compressor Cooling Water Sewer	
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water/ Storm Water		Cooling Water/ Storm Water	
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	None		None	
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None		None	
		TOXICITY TESTS SAMPLING FREQUENCY:	None		None	
		FREQUENCY OF SAMPLING:	M	Q	M	Q
ANALYTICAL TEST GROUP		PARAMETERS TO BE ANALYZED				
3	Hydrogen ion (pH)	Hydrogen ion (pH)	X		X	
5a	Organic carbon	Dissolved organic carbon (DOC)	X		X	
5b		Total organic carbon (TOC)				
8	Suspended solids	Total suspended solids (TSS)	X		X	
		Volatile suspended solids (VSS)				
9	Total metals	Aluminum	X		X	
		Beryllium	X		X	
		Cadmium	X		X	
		Chromium	X		X	
		Cobalt	X		X	
		Copper	X		X	
		Lead	X		X	
		Molybdenum	X		X	
		Nickel	X		X	
		Silver	X		X	
		Thallium	X		X	
		Vanadium	X		X	
		Zinc	X		X	
11	Chromium (Hexavalent) (NOTE 1)	Chromium (Hexavalent)	X		X	
13	Total alkyl lead (NOTE 2)	Tetra-alkyl lead	X		X	
		Tri-alkyl lead	X		X	

SCHEDULE L: WESTERN FOUNDRY COMPANY LTD. - WINGHAM

		NAME OF EFFLUENT STREAM:	Furnace Cooling Water Sewer		Core Machine/Compressor Cooling Water Sewer	
		EFFLUENT STREAM CLASSIFICATION:	Cooling Water/ Storm Water		Cooling Water/ Storm Water	
		CHARACTERIZATION SAMPLING FREQUENCY/SCHEDULE:	None		None	
		OPEN CHARACTERIZATION SAMPLING FREQUENCY:	None		None	
		TOXICITY TESTS SAMPLING FREQUENCY:	None		None	
		FREQUENCY OF SAMPLING:	M	Q	M	Q
ANALYTICAL TEST GROUP		**PARAMETERS TO BE ANALYZED**				
14	Phenolics (4AAP)	Phenolics (4AAP)	X		X	
25	Solvent Extractables	Oil and grease	X		X	
27	Polychlorinated Biphenyls (PCBs) (Total)	PCBs (Total)		X		X
MC1†	Metals	Iron	X		X	
		Magnesium	X		X	
MC2†	Fluoride	Fluoride	X		X	

PART IV

EXPLANATORY NOTES TO THE DRAFT EFFLUENT MONITORING REGULATION FOR THE METAL CASTING SECTOR

PART IV - EXPLANATORY NOTES TO THE DRAFT EFFLUENT MONITORING REGULATION FOR THE METAL CASTING SECTOR

INTRODUCTION

These Explanatory Notes provide an expanded description of each of the sections in the Draft Effluent Monitoring Regulation for the Metal Casting Sector in order to further the reader's understanding of the regulatory requirements.

In conjunction with the protocols and procedures outlined in Ontario Regulation 695/88, the General Effluent Monitoring Regulation, the Metal Casting Sector Regulation specifies the effluent monitoring requirements for each discharger, including sampling, analysis, flow measurement, toxicity testing and reporting.

SECTION 1: DEFINITIONS

This section does not redefine terms which are already defined in the Environmental Protection Act under which the Metal Casting Sector Regulation is written.

This section of the Regulation provides:

- clarification of the terms used in the Regulation having several possible interpretations;

- definitions of the technical terms used in the Regulation which may not be in common usage;

- definitions of the terms which have different meanings in the Regulation than those found in a dictionary or through common use;

- definitions of those terms which have different uses in the Metal Casting Sector Regulation than those in the General Regulation; and

- definitions of the terms which are specific to the Metal Casting Sector.

Subsection 1(2) states that the definitions in section 1 of the General Regulation also apply to this Regulation. However, a re-defined term in the Metal Casting Sector Regulation supercedes that of the General Regulation.

All of the definitions in the General Regulation have been applied to the Metal Casting Sector Regulation with the following exceptions:

- characterization has been redefined to reference the metal casting sector characterization schedules which are specific to the metal casting sector;

- combined effluent has been redefined to include storm water;

- grab sample has been redefined to reference the appropriate laboratory sample containers for compounds specific to the metal casting sector monitoring list.

The following definitions are included in the Metal Casting Sector Regulation rather than the General Regulation as they are referred to only in the context of the Metal Casting Sector Regulation:

- cooling water effluent;

- cooling water effluent stream;
- cooling water effluent sampling point;
- process change.
- combined collection system.

SECTION 2: PURPOSE

The purpose of the Metal Casting Sector Regulation is to establish a data base on effluent quality in the Metal Casting Sector that will be used, along with other pertinent information such as available treatment technology, to develop effluent limits for the Metal Casting Sector and to quantify the mass loadings of monitored contaminants discharged into surface watercourses.

SECTION 3: APPLICATION

Subsections 3(1) and 3(2) identify the metal casting plants to which this Regulation applies. Section 3(2) lists twelve plants and identifies the respective site-specific monitoring schedule that applies to that plant.

Subsection 3(3) states that the Metal Casting Sector Regulation is a Sectoral Effluent Monitoring Regulation in the context of the General Regulation.

Subsection 3(4) states that all the monitoring obligations of the Metal Casting Sector Regulation shall be carried out in accordance with the requirements of the General Regulation and Schedules CC and DD of this regulation which state the sampling principles, analytical principles and analytical method detection limits for parameters specific to the metal casting sector.

Subsection 3(5) pertains to actions performed by persons other than the direct discharger. That is, a consultant or laboratory that collects and/or analyzes the samples for the discharger has in effect carried out the obligations of that discharger.

Subsection 3(6) requires direct dischargers to notify the Director of any changes in ownership or name of any plant in the metal casting sector.

SECTION 4: SAMPLING

This section specifies that a sampling point must be established by the direct discharger for each effluent stream specified in the respective site-specific monitoring schedule. These sampling points must be used for all sampling required by the Metal Casting Sector

Regulation unless an alternate sampling location is deemed acceptable by a Regional Director of the Ministry of the Environment.

SECTION 5: CHARACTERIZATION AND OPEN CHARACTERIZATION

Characterization and open characterization samples must be collected and analyzed according to the principles and protocols outlined in sections 3 and 4 of the General Regulation for sampling and analysis respectively.

The site-specific monitoring schedules for each direct discharger indicate the required frequency and schedule for performing characterization and frequency for performing open characterization.

In general, direct dischargers are required to perform characterization and open characterization once in each quarter for all process and combined effluent streams. Characterization for process and combined effluent streams consists of analyses for all parameters on Schedule AA which includes ATGs 1 through 27 with the exception of ATGs 21 and 22, herbicides and pesticides. Monitoring for ATG 24, chlorinated dibenzo-p-dioxins and dibenzofurans, is required in the first and third quarter only.

Cooling water effluent streams that contain only small quantities of process effluent and combined effluents in which all process components are monitored separately are required to perform characterization once in each quarter for all parameters listed on Schedule BB. Schedule BB includes ATGs 1 through 20 and 25 through 27. Open characterization is required semi-annually for these combined effluent streams.

Characterization and open characterization is required after each process change which may affect the chemical composition of the effluent.

To ensure that monitoring covers all seasons, samples should be collected no sooner than six weeks and no later than four months after the previous quarterly sampling.

Streams designated for characterization are marked with the appropriate frequency and schedule next to the heading Characterization Frequency/Schedule. Streams designated for open characterization are marked with the appropriate frequency next to the heading Open Characterization Frequency. Open characterization is defined in the General Regulation.

SECTION 6: DAILY MONITORING - PROCESS EFFLUENT AND COMBINED EFFLUENT

All process and some combined effluent streams, as designated in the monitoring schedules, have daily monitoring requirements. The parameters required to be monitored daily are specified under the column marked 'D' under effluent streams designated as process or combined effluent streams in the monitoring schedules. Typically, process and combined effluent streams are required to be monitored daily for the following Analytical Test Groups (ATG):

- Group 3 Hydrogen Ion (pH);
- Group 7 Specific Conductance;
- Group 8 Suspended Solids; and
- Group 14 Phenolics (4AAP).

Combined effluent streams in which all process components are monitored separately, do not require daily monitoring.

Some site-specific schedules may vary. The 'Technical Rationale' explains these site-specific variations.

Hydrogen ion (pH) and specific conductance are required to be monitored daily to provide an account of the day to day variations in effluent quality. Continuous on-line analyzers are preferred to 24 hour composite samples, since, on-line analyzers provide a continuous account of effluent variability.

SECTION 7: THRICE WEEKLY MONITORING - PROCESS EFFLUENT AND COMBINED EFFLUENT

All process and combined effluent streams, as designated in the monitoring schedules, have thrice weekly monitoring requirements. The parameters required to be monitored thrice weekly are specified under the column marked 'TW' under effluent streams designated as process or combined effluent streams in the monitoring schedules. Typically, process and combined effluent streams are required to be monitored thrice weekly for the following ATGs:

- Group 1 Chemical Oxygen Demand;
- Group 4a Ammonia plus Ammonium;
- Group 9 Total Metals;
- Group 11 Chromium (Hexavalent);
- Group 25 Oil and Grease;

- Group MC1 Metals (Iron and Magnesium); and
- Group MC2 Fluoride.

Group 11 is required to be monitored thrice weekly only if total chromium exceeds 1 mg/l.

Combined effluent streams in which all process components are monitored separately, are required to monitor thrice weekly those compounds or parameters which are included in the daily requirements for process streams.

Some site-specific schedules may vary. The 'Technical Rationale' explains these site-specific variations.

Thrice Weekly samples are required to be collected on different days in the week to ensure that all normal operating conditions are monitored.

SECTION 8: WEEKLY MONITORING - PROCESS EFFLUENT AND COMBINED EFFLUENT

All process and combined effluent streams, as designated in the monitoring schedules, have weekly monitoring requirements. The parameters required to be monitored weekly are specified under the column marked 'W' under effluent streams designated as process or combined effluent streams in the monitoring schedules. Process and combined effluent streams are required to be monitored weekly for ATG 5a (Dissolved Organic Carbon) and ATG 6 (Total Phosphorus). ATG 4b (Nitrate plus Nitrite) and phenanthrene and naphthalene from ATG 19 (Extractables, Base Neutral) are required to be monitored weekly in some site-specific cases.

Combined effluent streams in which all process components are monitored separately, are required to be monitored weekly for those compounds or parameters which are included in the thrice weekly and weekly requirements for process streams.

Some site-specific schedules may vary. The 'Technical Rationale' explains these site-specific variation.

A minimum of four days between consecutive weekly samples is required in order to avoid sample correlation and thus, increase sample randomness.

SECTION 9: MONTHLY MONITORING - PROCESS EFFLUENT AND COMBINED EFFLUENT

All process and combined effluent streams, as designated in the monitoring schedules, have monthly monitoring requirements. The

parameters required to be monitored monthly are specified under the column marked 'M' under effluent streams designated as process or combined effluent streams in the monitoring schedules. Typically, process and combined effluent streams are required to be monitored monthly for the following ATGs:

- Group 2 Cyanide;
- Group 12 Mercury;
- Group 13 Total Alkyl Lead;
- Group 15 Sulfides;
- Group 16 Volatiles, Halogenated;
- Group 17 Volatiles, Non-Halogenated;
- Group 18 Volatiles, Water Soluble;
- Group 19 Extractables, Base Neutral;
- Group 20 Extractables, Acid (Phenolics);
- Group 26 Fatty and Resin Acids; and
- Group 27 PCBs (Total).

Combined effluent streams in which all process components are monitored separately, are not required to monitor monthly for these compounds. Monitoring the process stream, upstream of the combined effluent stream is sufficient. These streams will be monitored monthly only for parameters that will aid in the interpretation of biomonitoring data.

Some site-specific schedules may vary. The 'Technical Rationale' explains these site-specific variation.

An interval of two weeks between successive monthly samples is required in order to provide independent samples over as wide a range of operating conditions as possible.

SECTION 10: MONTHLY AND QUARTERLY MONITORING - COOLING WATER EFFLUENT

Cooling water effluent streams are required to be monitored monthly for as many as six parameters and quarterly for PCBs, if PCBs are stored or used on-site.

Cooling water will be monitored for parameters that are representative of plant processes in order to determine if contamination of cooling water has occurred. Some or all of the

following parameters are included in the monitoring of cooling water:

- Hydrogen Ion (pH);
- Dissolved Organic Carbon;
- Total Suspended Solids;
- Total Metals;
- Total Phenolics (4AAP);
- Oil and Grease; and
- PCBs.

Cooling water effluent streams that contain small quantities of process effluent are designated as cooling water effluent streams for flow measurement purposes, however, these streams have characterization requirements associated with them. The characterization requirements are describe under the section 5.

The parameters required to be monitored monthly or quarterly are specified under the columns marked 'M' and 'Q' under effluent streams designated as cooling water effluent streams in the monitoring schedules.

SECTION 11: MONTHLY AND QUARTERLY MONITORING - STORM WATER EFFLUENT

A total of 12 samples, including a minimum of two samples during thaws, are required during discharges of storm water at each affected storm water sampling point. Thaw samples are needed to provide an indication of the losses of contaminants during the winter months.

In cases where samples cannot be collected from a storm water sampling point because of a lack of sufficient volume of discharge, an additional set of samples must be collected in the following month in order to provide a total of 12 data points.

Samples should be collected towards the beginning of the discharge in order to catch the "first flush" effects.

Storm water samples are required to be monitored monthly for as many as seven parameters and quarterly for PCBs, if PCBs are stored or used on-site.

The list of parameters to be analyzed reflect those that may potentially contaminate the storm water effluent either through continually occurring spills to the collection system or by run-off

from material storage areas. Some or all of the following parameters are included in the monitoring of storm water:

- Hydrogen Ion (pH);
- Dissolved Organic Carbon;
- Total Suspended Solids;
- Total Metals;
- Total Phenolics (4AAP);
- Oil and Grease;
- Fluorides; and
- PCBs.

The parameters required to be monitored monthly or quarterly are specified in the columns marked 'M' and 'Q' respectively, under effluent streams designated as storm water effluent streams in the monitoring schedules.

SECTION 12: QUALITY CONTROL MONITORING

Each of the quality control samples to be collected provides different information about the quality of the effluent samples collected and indicates possible field contamination. Only process effluents will require field quality control samples as these effluents will be monitored to a greater extent and will be used in the development of effluent limits. Information obtained from the quality control samples will be used as an indicator of sampling variability for other effluents.

Monthly quality control monitoring of one process effluent stream is required for those parameters which are analyzed on a daily and thrice weekly basis. These quality control samples are collected on the same days as the daily and thrice weekly samples specified in sections 6 and 7 respectively.

Quarterly quality control monitoring of one process effluent stream is required for those parameters which are analyzed on a weekly and monthly basis. The quality control samples are collected on the same day as the weekly and monthly samples specified in sections 8 and 9.

A duplicate sample provides a measure of the reproducibility of sampling techniques used at the site including the integrity of the sample containers.

A travelling blank sample will provide an indication of any problems with sample contamination due to extraneous volatile fractions of contaminants in the atmosphere and any contaminants introduced by handling of the sample containers. Analytical test groups 1 (COD), 3 (pH) and 8 (TSS/VSS) are excluded from the analysis.

Travelling blanks for COD and TSS/VSS are relatively ineffective. Gross contamination would be required to be detected at the ppm levels of detection for these tests. No information relevant to samples is to be gained for pH on a travelling blank of distilled water.

A travelling spiked blank sample should provide an indication of the degree of degradation of the target parameters from sampling to analysis, which in turn may indicate degradation of the target parameters in the effluent sample itself. Only analytical test groups 16 through 24, 26 and 27 are to be analyzed as they are most likely to volatilize or degrade in the unpreserved solution.

Travelling spiked blanks are not required for the conventionals and metals. Inorganic parameters in samples are stable. Most of the samples are either preserved or are analyzed within very short time periods.

The travelling spiked blank samples must be prepared with a standard solution which contains all of the parameters in the analytical test groups for which the analyses are required.

Additional quality control samples are to be prepared and analyzed by the laboratory, as outlined in section 4 of the General Regulation. These samples will provide an indication of analytical variability and laboratory contamination due to the analytical procedures.

SECTION 13: TOXICITY TESTING

Section 5 of the General Regulation specifies the test protocols which must be followed for the fish toxicity test and the Daphnia magna acute lethality toxicity test. The test protocols are published in the following Ministry of the Environment documents:

- "Protocol to Determine the Acute Lethality of Liquid Effluents to Fish", dated July 1983; and
- "Daphnia magna Acute Lethality Toxicity Test Protocol" dated April 1988.

Toxicity test samples are to be collected at each effluent sampling point designated for toxicity testing in the site-specific monitoring schedules at the frequency specified in that schedule.

Monthly samples, required for process and combined effluent streams, must be collected on the same day as the routine monthly monitoring samples for that same effluent stream in order to aid in the interpretation and possible correlation of the chemical analyses and the resultant biological effects. If routine monthly chemical analyses are not required for that stream, the toxicity samples must be collected on the same day as the monthly samples for the upstream process effluent stream.

Effluent samples used for the fish toxicity and Daphnia magna tests are to be taken from the same sample container or set of containers in order to minimize the likelihood of sample differences.

In the case where three monthly fish toxicity tests result in mortality for no more than 20% of the population at each effluent concentration in the serial dilution, toxicity tests may be performed on 100 percent undiluted test solutions for the subsequent fish toxicity tests. Full series dilution LC50 fish toxicity testing would resume for a given stream if any one of the single concentration tests on full strength effluent only showed mortality above 20%.

It is not unusual for one fish in a sample to suffer mortality due to natural causes. Therefore, mortality greater than two fish in most cases would be an indication of some effluent lethality.

Daphnia magna acute lethality test will be performed monthly using full series dilutions.

Quarterly toxicity tests using both the fish toxicity test and Daphnia magna acute lethality test are required for those cooling water effluent streams so designated for toxicity testing in the monitoring schedules. Quarterly samples, required for those cooling water effluent streams, must be collected on the same day as the characterization samples for that effluent stream. The single concentration fish toxicity test on full strength effluent is not applicable to cooling water effluent stream toxicity testing.

SECTION 14: FLOW MEASUREMENT

Protocols and procedures for flow measurement are outlined in section 6 of the General Regulation.

Flow measurement accuracy requirements are a function of stream type. A flow measurement accuracy of plus or minus 5% of the actual flow for primary devices and plus or minus 2% of full scale flow for secondary devices is required for all process effluent streams to be measured by new flow measurement devices. This accuracy is required to establish accurate loadings on those streams. A flow measurement accuracy of not greater than plus or minus 15% is allowed for existing flow measurement devices.

Combined effluent streams are required to be continuously measured within an accuracy of plus or minus 20%. This is required to quantify the contaminant loadings from sources other than the main process effluent which is monitored separately.

Cooling water and storm water effluent streams are required to be calculated, estimated or measured within an accuracy of plus or minus 20%. This accuracy applies to the total volume of cooling water discharged in the sampling day and the total volume of storm water discharged from the monitored storm event. The duration of each monitored storm event must also be measured and recorded.

Flow measurement requires the use of primary and secondary flow measurement devices. Typical primary flow measurement devices are:

- parshall flumes;
- weirs;
- orifice plates;
- mag meters;
- venturi meters.

Typical secondary flow measurement devices are electronic interfaces with the primary devices which interpret the measurements and convert them to usable flow data. These data are commonly presented in a continuous chart form or discrete readout. A continuous chart is preferred to provide a record of the flow variability.

The General Regulation requires that good maintenance practices be followed for all flow measurement devices and that calibration of these measurement devices be carried out periodically.

SECTION 15: EXTENDED MONITORING - EVERY THIRD OPERATING DAY

All process and combined effluent streams are required to be monitored beyond the one year monitoring program specified in this Regulation. The parameters required to be monitored every third day are those parameters associated with daily monitoring under the one year program and include hydrogen ion (pH), suspended solids and phenolics (4AAP).

These monitoring requirements replace the existing IMIS requirements and continue until replaced by the monitoring requirements of the effluent limits regulation.

SECTION 16: EXTENDED MONITORING - WEEKLY

The parameters required to be monitored weekly under the extended monitoring program are those parameters required to be monitored on a thrice weekly and weekly basis during the first year.

SECTION 17: REPORTING

Section 7 of the General Regulation outlines the reporting requirements for each direct discharger. The contents of the Initial Report to be submitted prior to monitoring under the Regulation are outlined in the General Regulation.

All information which is considered by the plant to be confidential business information must be so identified on each such page submitted to the Ministry.

The Initial Report must be submitted to the Regional Director of the Ministry within three months and seven days following promulgation of the Regulation. This report is intended to provide the Ministry with a clear understanding of plant processes and the procedures each plant will follow in carrying out the requirements of this Regulation. Four copies of the Initial Report, including any attachments, should be provided.

A guidance document will be available from the Ministry prior to promulgation of the Metal Casting Sector Regulation to provide assistance in preparing the Initial Report.

Results from all analyses performed by the laboratory must be reported, including all positive numerical values at or above the laboratory calculated method detection limit.
In those cases where a laboratory has a method detection limit lower than the maximum allowed by the Regulation, all positive values below the MISA method detection limit must be reported. This will ensure that accurate data is reported.

Flow measurement information must be reported for all process effluent, combined effluent and cooling water effluent streams. The duration and approximate volume of discharge of storm water, is to be reported.

The date and duration of each storm event, the amount of rainfall and the approximate duration of each discharge is required. This information is required in order to correlate the analytical data with the event which occurred. A heavy rainfall or a close succession of storm events may lead to dilution not only of the storm water but also other effluents and thereby impact the analytical results.

A schedule of the sampling dates and times for monthly and quarterly sampling is required for Ministry inspection purposes. Inspection samples will be collected for the Ministry concurrent with the collection of samples by the plant site. Sampling procedures used at the plant will also be checked during Ministry inspections.

The quantities of chemicals added to cooling water are required in order to provide a greater understanding of the potential and degree of contamination. Routine monitoring of cooling water is designed to identify long-term leaks from process streams.

A flow variability report, as specified in subsection 3(5) of the General Regulation, is required for each process effluent stream and combined effluent stream from which samples were collected other than by means of an automatic flow proportional composite sampling device. This report is intended to be used by the plant to show that the effluent flow is non-variable and therefore would not require flow proportional sampling for further collection of samples.

Failure to provide a flow variability report will result in designation of the effluent stream as a variable flow stream requiring flow proportional sampling 3 months following the report due date.

A report detailing any equipment malfunctions or any other problems which interfere with carrying out the requirements of both the General and Metal Casting Sector Regulations, and the remedial action taken, must be provided. The reasons for non-compliance with the requirements, as documented in this report, may be taken into consideration by abatement and enforcement staff investigating an act of non-compliance.

All other records which are required to be kept by this section are primarily for inspection purposes to ensure compliance with this Regulation. The records should be kept for a period of two years beyond the submission of the last report in compliance with the requirements of the Metal Casting Sector Regulation.

SECTION 18: TIMING

The Initial Report is required within three months and seven days following promulgation of the Regulation.

The sampling, analytical, flow measurement, toxicity testing and reporting requirements come into force five months after promulgation of the Regulation. The five month implementation period is intended to provide sufficient time to allow the plant site to purchase and install equipment, negotiate contracts with laboratories, set up their monitoring programs and train personnel. The requirements of sections 5 to 13 and 17(5) are revoked one year after coming into force. In order to provide sufficient monitoring

during the period before the effluent limits regulation is promulgated, there will be every third day and weekly monitoring requirements for process and combined effluent streams. These monitoring requirements will include the parameters that are listed in the daily, thrice weekly and weekly columns of the respective site-specific monitoring schedules.

Every third day and weekly samples must be collected and analyzed according to the principles and protocols followed during the twelve month monitoring period. Flow measurement of these streams must continue with the accuracy specified in the General Regulation. Reporting of all analytical and flow measurement results is required according to the General Regulation. Monthly and quarterly monitoring, quality control monitoring and toxicity testing will not continue under this Regulation beyond 12 months.

PART V

MISA ADVISORY COMMITTEE REPORT REGARDING THE DRAFT EFFLUENT MONITORING REGULATION FOR THE METAL CASTING SECTOR

Ontario

Ministry of the Environment | Ministère de l'Environnement

135 St. Clair Avenue West
Suite 100
Toronto, Ontario
M4V 1P5

135, avenue St. Clair ouest
Bureau 100
Toronto (Ontario)
M4V 1P5

March 31, 1989

The Honourable Jim Bradley
Minister of the Environment
135 St. Clair Avenue West
Toronto, Ontario
M4V 1P5

Dear Mr. Minister:

Attached is the MISA Advisory Committee Report regarding the Draft Effluent Monitoring Regulations for the Metal Casting Sector provided in response to your letter of February 13, 1989.

The report has the unanimous support of MISA Advisory Committee members, including the representative of the Metal Casting Sector, Mr. Ian Hennessy.

The Committee commends the industry and the Ministry for participating in a successful consensus building process, and in the joint submission of a complete and well documented regulation package.

Respectfully submitted,

J.W. MacLaren.

Jim MacLaren
Chairman
for the MISA Advisory Committee

ONTARIO MINISTRY OF THE ENVIRONMENT
MUNICIPAL/INDUSTRIAL STRATEGY FOR ABATEMENT

MISA Advisory Committee

REPORT regarding the
EFFLUENT MONITORING REGULATIONS FOR
the METAL CASTING SECTOR

March 1989

Jim MacLaren
Chairman

Ian Hennessy
representative for the
Metal Casting Sector

MISA ADVISORY COMMITTEE REPORT regarding the EFFLUENT MONITORING REGULATIONS FOR THE METAL CASTING SECTOR

1. INTRODUCTION

The documents comprising the draft **Effluent Monitoring Regulations** for the Metal Casting Sector were referred by the Minister of the Environment to the **MISA Advisory Committee** on February 13, 1989. At Committee Meeting 45, February 10, 1989, the Committee received input from Ministry staff and representatives of the industrial sector.

The Committee member and representative for the Metal Casting Sector was Ian Hennessy, Chairman of the Metal Casting Environmental Committee. Dr. Isobel Heathcote was the **MISA Advisory Committee's** observer to the Joint Technical Committee.

2. ADVICE TO THE MINISTER

The **MISA Advisory Committee** has reviewed the draft regulation package, and generally supports the regulation, recommending that the regulation package be released for public scrutiny.

3. REGULATION-SPECIFIC RECOMMENDATION

3.1 The **MISA Advisory Committee** recommended that in the interests of acquiring a threshold level of detail on effluent quality for the purpose of loading estimates and inter-sector comparison, a more intense monitoring effort be applied to the two higher volume plants which have effluent flow rates approximately 100 times greater than those of the other plants in the sector. While the limited pre-regulation monitoring data base does not provide sufficient evidence to make assumptions about the presence of compounds "at elevated concentrations", the Committee is generally satisfied with the additional explanations and adjustments made to focus scrutiny on the priority pollutants, especially phenolic compounds **(ATG 14;20)** base neutral extractables **(ATG 19)** and halogenated volatiles **(ATG 16).**

3.2 Recognizing that cooling waters are a potential source of contaminants, and because of the precedent of previous regulations to require at least limited toxicity testing on all cooling water effluents, the **MISA Advisory Committee** recommends that the toxicity testing requirements be applied to all cooling waters at a minimum on a quarterly basis.

4. PROGRAM-SPECIFIC RECOMMENDATIONS

4.1 Draft **MISA** monitoring regulations to date have referenced the United States Environmental Protection Agency development documents on effluent limit guidelines and standards, and have employed some **BAT** criteria and levels therein as the basis for frequency assignment of compounds to the **MISA** monitoring schedules. While recognizing that the **USEPA BAT** criteria and levels may be obsolete, the **MISA Advisory Committee** recommends that if these criteria are to be used at all, they be applied in a consistent and comparable manner from **MISA** sector to **MISA** sector.

4.2 As the limits regulation phase approaches, the **MISA Advisory Committee** recommends that for all sectors, the Ministry gather and publish background information on **BATEA** requirements in other jurisdictions.

MISA Advisory Committee Report regarding the Draft Monitoring Regulations for the Metal Casting Sector

Submitted, March 31, 1989

MISA ADVISORY COMMITTEE

Jim MacLaren, Chairman

Harvey Clare, Member

Isobel Heathcote, Member

Paul Hebert, Member

Don MacKay, Member

Kal Millyard, Member

Ian Hennessy, Member
representing the Metal Casting Sector

PART VI

MINISTRY OF THE ENVIRONMENT RESPONSE TO THE MISA ADVISORY COMMITTEE REPORT

Ontario

Office of the Minister

Ministry of the Environment

135 St. Clair Avenue West
Toronto, Ontario
M4V 1P5
416/323-4359

April 3, 1989

Mr. J. MacLaren
Chairman
MISA Advisory Committee
Suite 502
112 St. Clair Avenue West
Toronto, Ontario
M4V 1N3

Dear Mr. MacLaren:

I would like to thank you and the members of the MISA Advisory Committee (MAC) for your review of the Draft Effluent Monitoring Regulation for the Metal Casting Sector.

I am attaching the Ministry's response to specific recommendations made by MAC on the Metal Casting Sector Monitoring Regulation.

I hope that this response will assist members of the public in reviewing the regulation and providing comments.

Yours sincerely,

Jim Bradley

Jim Bradley
Minister

Enclosure

RESPONSE TO THE MISA ADVISORY COMMITTEE (MAC) RECOMMENDATIONS ON THE DRAFT MONITORING REGULATION

Throughout the regulation development process, the MISA Advisory Committee (MAC) has reviewed selected drafts of the regulation and provided comments to the Joint Technical Committee for the Metal Casting Sector (JTC). Many of these comments have been accepted and incorporated into successive versions of the draft regulation package. The Committee, after reviewing the penultimate draft, submitted its report which is available for public review.

The major recommendations from MAC and the corresponding MOE responses are provided as follows:

A. REGULATION-SPECIFIC COMMENTS

1. MAC's Recommendation

MAC recommended that a more intense monitoring effort be applied to the two higher volume plants.

MOE Response

The Ministry of the Environment has carefully considered MAC's recommendation and has since made adjustments to increase the frequency of monitoring for selected parameters in the base neutral extractable group (ATG 19) from monthly to weekly for the two higher volume plants (General Motors of Canada Limited and the Ford Motor Company of Canada Limited). These adjustments have been incorporated into the final draft of the Regulation.

With these adjustments, the Ministry of the Environment is confident that the proposed monitoring program for phenolic compounds (ATG 14 and ATG 20), halogenated volatiles (ATG 16) and base neutral extractables (ATG 19) will focus scrutiny on these priority pollutants. The proposed monitoring program will generate a suitable database to support the development of effluent limits for the Metal Casting Sector.

2. MAC's Recommendation

Recognizing that cooling waters are a potential source of contaminants, and because of the precedent of previous regulations to require at least limited toxicity testing on all cooling water effluents, MAC recommends that the toxicity testing requirements be applied to all cooling waters at a minimum on a quarterly basis.

MOE Response

Toxicity testing for cooling water effluent streams will be conducted at six of the twelve regulated metal casting plants. Three plants will conduct toxicity testing on a monthly basis and three plants will conduct toxicity testing on a quarterly basis.

In the judgement of the Joint Technical Committee, toxicity testing for cooling water effluent streams is not required for the remaining six small metal casting plants.

In view of MAC's recommendation, the Ministry will re-examine its position on this issue and will make a final decision before the Metal Casting Sector Effluent Monitoring Regulation is promulgated.

It should be noted that the Ministry will also conduct toxicity tests on cooling water effluent streams as part of the MISA Audit Program. Specifically, this will include two toxicity tests on cooling water effluent streams from each of the six small metal casting plants.

B. PROGRAM-SPECIFIC RECOMMENDATIONS

3. MAC's Recommendation

While recognizing that the U.S. EPA BAT criteria and levels may be obsolete, MAC recommends that when they are used as criteria for frequency assignment, they be applied in a consistent and comparable manner from MISA sector to MISA sector.

MOE Response

MAC's recommendation will be given due consideration in the regulation development process bearing in mind that each industrial sector is different.

4. MAC's Recommendation

As the Effluent Limits Regulation phase approaches MAC recommends that the Ministry gather and publish background information on BATEA requirements in other jurisdictions for all industrial sectors.

MOE Response

This Ministry accepts MAC's recommendation. BATEA requirements in other jurisdictions will be collected during the development of the Effluent Limits Regulations.